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A influência das *quality cues* da carne bovina no comportamento do consumidor brasileiro

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Tese apresentada para obtenção do título de Doutora em Ciências. Área de concentração: Ciência Animal e Pastagens

Piracicaba
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versão revisada de acordo com a Resolução CoPGr 6018 de 2011

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“A tarefa não é tanto ver aquilo que ninguém viu,
mas pensar o que ninguém ainda pensou sobre aquilo que todo mundo vê.”

Arthur Schopenhauer

SUMÁRIO

RESUMO

A influência das *quality cues* da carne bovina no comportamento do consumidor brasileiro

A carne bovina possui *quality cues* específicas que podem indicar aos consumidores o nível de qualidade do alimento e auxiliá-los no processo de escolha para compra. As *quality cues* valorizadas dependem do nível de familiaridade com a carne, tipo de informações disponíveis, experiências anteriores, valores pessoais e origem do consumidor. Considerando a relevância do comportamento de consumidores para a indústria produtora e vendedora de carne bovina, o presente trabalho objetivou explorar como as *quality cues* cor, marmoreio, raça, aroma, sabor e maciez da carne bovina são compreendidas pelos consumidores, assim como identificar quais são mais relevantes para tomada de decisão de compra. Também objetivou-se destacar quais *quality cues* poderiam ser melhor exploradas pela indústia e regulamentas por órgãos fiscalizadores. Para atendimento dos objetivos foram realizados três estudos distintos com consumidores da região sudeste brasileira no ano de 2020, apresentados em formato de capítulos. Para o estudo apresentado no capítulo I foi aplicado um questionário online com 533 consumidores da região sudeste brasileira e foi identificado que existem *quality cues* capazes de aumentar ou reduzir a probabilidade de compra, bem como a disposição dos consumidores em pagar, além disso, o comportamento do consumidor muda conforme o nível de envolvimento com a carne bovina. O estudo apresentado no capítulo II foi realizado de forma presencial na cidade de Piracicaba - SP, com 23 consumidores amostrados por conveniência, e foi mensurada a atenção visual às *quality cues* de carne bovina, com auxílio do equipamento *eye tracking*. Nesse estudo foi encontrado que *quality cues* não compreendidas pelos consumidores ao serem visualizadas reduzem a probabilidade de compra e, por isso, é necessário um trabalho de edução dos consumidores para que compreendam e utilizem informações adicionais na tomada de decisão. Por fim, no estudo apresentado no capítulo III foi realizada uma entrevista de profundidade, utilizando a técnica de *laddering* para a identificação dos valores pessoais dos participantes. Esse estudo foi realizado em conjunto com o estudo do capítulo II, de modo que antes da entrevista os participantes foram previamente estimulado pelas imagens apresentadas no equipamento *eye tracking*. Foram utilizados somente informações referentes a cor, marmoreio, sabor e maciez, totalizando uma amostra de 15 consumidores. Nesse último estudo foi identificado que o comportamento de escolha de carne bovina da amostra foi motivado principalmente pelo prazer e segurança, ressaltando que o prazer foi o único valor comum à todas *quality cues* estudadas. A realização desses três estudos possibilitou encontrar que existem diferenças na motivação e comportamento de escolha dos consumidores brasileiros em relação aos consumidores de países desenvolvidos e também que existem oportunidades para órgãos reguladores padronizarem as *quality cues* da carne bovina, especialmente aquelas relacionadas à qualidade sensorial. Além disso a indústria tem a tarefa de educar o consumidor sobre as *quality cues* comunicadas, para garantir correta comunicação e utilização das informações. Estudos complementares são recomendados.

Palavras-chave: Qualidade da carne, Atributos da carne bovina, Atenção visual, *Eye tracking*, *Laddering*

ABSTRACT

The influence of beef quality cues on Brazilian consumer behavior

Beef has specific quality cues that can indicate to consumers the quality level of the food and help them in the process of choosing to purchase. The quality cues valued depend of familiarity level with meat, information available, previous experiences, personal values and consumer origin. Considering the relevance of consumer behavior for the beef producing and selling industry, this study aimed to explore how the quality cues of beef color, marbling, breed, aroma, flavor and tenderness are understood by consumers, as well as to identify which are most relevant for making a purchase decision. It also aimed to highlight which quality cues could be better explored by the industry and regulated by regulatory government agencies. In order to meet the objectives, three different studies were carried out with southeast Brazilian consumers in the in 2020, presented in the form of chapters. For the study presented in Chapter I, an online questionnaire was applied to 533 consumers in the southeastern region of Brazil and it was identified that there are quality cues capable of increasing or reducing the probability of purchase, as well as the consumers willingness to pay, in addition, the behavior of the consumer changes according to the beef involvement level. The study presented in chapter II was carried out in person in the city of Piracicaba - SP, with 23 consumers sampled for convenience, and the visual attention to the quality cues of beef was measured, with the aid of eye tracking equipment. In this study, it was found that quality cues that are not understood by consumers when viewed reduce of purchase likelihood therefore, it is necessary to educate consumers so that they understand and use additional information when making decision. Finally, in the study presented in chapter III, an in-depth interview was carried out, using the laddering technique to identify the personal values of the participants. This study was carried out in conjunction with the study in Chapter II, so that before the interview the participants were previously stimulated by the images presented in the eye tracking equipment. Only information regarding color, marbling, flavor and tenderness was used, totaling a sample of 15 consumers. In this last study, it was identified that the behavior of choosing beef in the sample was mainly motivated by pleasure and safety, emphasizing that pleasure was the only value common to all quality cues studied. The realization of these three studies made it possible to find that there are differences in the motivation and choice behavior of Brazilian consumers in relation to consumers in developed countries and also that there are opportunities for regulatory government agencies to standardize the quality cues of beef, especially those related to sensory quality. In addition, the industry has the task of educating the consumer about the quality cues communicated, to ensure correct communication and use of information. Complementary studies are recommended.

Keywords: Meat quality, Beef attributes, Visual attention, Eye tracking, Laddering

1. INTRODUÇÃO

Os consumidores mensuram a qualidade e tomam decisões de compra de alimentos com base na avaliação das *quality cues* intrínsecas e extrínsecas disponíveis nos rótulos, as quais oferecem informações sobre o produto e dicas de qualidade que auxiliam na criação de expectativas e no processo de escolha (Grunert, Larsen, Madsen, Baadsgaard, 1995). Nesse contexto, a escolha de um alimento pode ser traduzida como *trade-off* entre nível de *quality cues* e obtenção das características desejáveis (Grunert, Bredahl, Brunsø, 2004) e a qualidade percebida dos alimentos compreende dimensões sensoriais, de saúde, conveniência e processos (Bredahl, 2004).

O processo de percepção da qualidade dos alimentos pelos consumidores é dividido em duas etapas principais, primeiro as expectativas de qualidade são formadas no ponto de compra através da credibilidade, experiências anteriores e avaliação das *quality cues* disponíveis no produto, em seguida, após o consumo do alimento, a qualidade esperada do produto poderá ser validada ou não (Bredahl, 2004; Grunert, Bredahl, Brunsø, 2004; Grunert, Larsen, Madsen, Baadsgaard, 1995). Após a compra, o consumidor corre o risco de ter experiência de qualidade diferente daquela esperada, isso acontece principalmente quando a escolha do alimento é baseada em atributos de baixo grau preditivo. Cabe ressaltar que, assim como a escolha do alimento é influenciada pela situação de compra, a qualidade experimentada também pode ser influenciada pelo produto em si, modo de preparo, tipo de refeição, humor, experiências anteriores e o grau de expectativa criada. E, dependendo do grau de satisfação, a probabilidade de repetir a compra pode aumentar ou diminuir (Grunert, Bredahl, Brunsø, 2004).

Considerando a carne bovina, as *quality cues* intrínsecas são relacionadas aos atributos objetivos da carne, como cor, corte, teor de gordura, raça, sabor, maciez, ou seja, são relacionadas às especificações técnicas da carne e características físicas que podem ser mensuradas (Aboah, Lees, 2020; Borgogno, Favotto, Corazzin, Cardello, Piasentier, 2015; Banović, Fontes, Barreira, Grunert, 2012). Por outro lado, as *quality cues* extrínseca representam todas as outras características do produto, como marca, preço, embalagem, entre outros (Morquecho-Campos, Graaf, Boesveldt, 2020; Meyerding, Gentz, Altmann, Meier-Dinkel, 2018, Brunsø, Fjord, Grunert, 2002; Grunert, Larsen, Madsen, Baadsgaard, 1995). Adicionalmente, considerando o contexto brasileiro, as *quality cues* apresentadas na carne bovina podem ser divididas em regulamentadas ou estratégicas, que serão descritas em maiores detalhes a seguir.

Quality cues regulamentadas são aquelas definidas como dizeres de rotulagem obrigatórios pelos órgãos públicos reguladores Ministério da Agricultura e Pecuária e Abastecimento (MAPA) e Agência Nacional de Vigilância Sanitária (ANVISA). Considerando carnes bovinas *in natura* (*fresh beef*) embaladas, são informações obrigatórias de rotulagem: denominação de venda do produto (nome), conteúdo líquido da embalagem, identificação da origem, informações de identificação do estabelecimento produtor ou importador, carimbo da inspeção federal, conservação do produto, marca, identificação de lote, data de fabricação, prazo de validade, número de registro, instruções de preparo e

uso, informações sobre alimentação transgênica (se aplicável) e selo orgânico (se aplicável) (Brasil, 2014; Brasil, 2005; Brasil, 2003). Facultativamente, podem ser apresentadas na rotulagem de carnes *in natura*: tabela nutricional, alegações nutricionais, denominações de qualidade, inscrições gráficas (selos) ou ilustrativas (*claims*), desde que não infrinjam regulamentos técnicos nem código de defesa do consumidor (Brasil, 2020; Brasil, 2005). Além disso, o consumidor conta com a aparência física das carnes, preço e recomendação de açougueiros.

Por outro lado, *quality cues* estratégicas são aquelas exploradas pela iniciativa privada na forma de *claims*, selos de qualidade ou certificações. Os *claims* fazem menção ao sistema de criação, tipo de alimentação e ainda região de criação do animal. Os selos de qualidade trabalham com faixas "*premium*", "super *premium*", "*gourmet*", "cortes selecionados", majoritariamente classificados de acordo com idade do animal, nível de marmoreio e raça (Coderre, Sirieix, Valette-Florence, 2022; Truong, Conroy, Lang, 2021). Além desses, são exploradas certificações orgânicas (Brasil, 2014), de bem-estar animal (ICHB 2023), selos ambientais (Rainforest Alliance, 2023), selos de raças específicas como por exemplo, Angus (ABA, 2023), Hereford (CCH, 2023), nelore (Nelore natural, 2023), dentre outras.

Conforme o exposto, nota-se que os órgãos reguladores brasileiros regulamentam *quality cues* com foco nutricional e na descrição geral das carnes. Por outro lado, algumas marcas definem critérios individuais para diferenciação dos cortes cárneos com base no marmoreio, idade, raça e sistema de criação. Esses critérios correm o risco de serem pouco preditivos e não entregar ao consumidor o produto com a qualidade "prometida", além disso, a utilização de atributos de qualidade sem a devida educação dos consumidores pode induzi-los ao erro. Com relação aos selos de certificadoras, somente o orgânico é regulado por legislação específica, os demais são organizados e fiscalizados por instituições de caráter privado e não governamentais. Nesses casos, há padronização dos critérios para utilização dos mesmos, mas, ainda assim, se concentram em *quality cues* referentes a modo de criação, abate e raça.

Assim, o consumidor ao comprar carne no Brasil dispõe de variadas *quality cues*, no entanto, são focadas em aspectos obrigatórios de legislação ou aspectos extrínsecos do sistema de produção. Pouco se explora as *quality cues* intrínsecas como sabor, maciez e cor, que podem ser relevantes para escolha ou não escolha do consumidor. Além disso, explora-se muito sobre raça e marmoreio, no entanto, não se sabe como os consumidores brasileiros compreendem essas *quality cues*. É importante destacar que a efetividade das informações na escolha é dependente do quanto os consumidores são capazes de compreender, do nível de envolvimento que o consumidor tem com o tipo de alimento e dos *trade-offs* percebidos entre dimensões de atributos destacados (Malheiros, Spers, Silva, Contreras-Castillo, 2022; Grunert, Hieke, Wills, 2014). Portanto, antes de explorar esse tipo de *quality cues* é importante avaliar se os consumidores entendem esse tipo de informação e como as utilizam no processo de tomada de decisão. Outro ponto importante é entender quais *quality cues* podem ser exploradas em diferentes ocasiões de compra, como por exemplo *fresh* ou *cooked beef*.

Adicionalmente, a carne bovina possui alta variação biológica e isso faz com que as experiências de qualidade sejam muito variáveis, o que dificulta o processo de percepção de qualidade dos consumidores. Mesmo que o consumidor compre carne da mesma marca, mesmo corte, ainda sim é possível que uma experiência de consumo anterior não se repita, devido à alta variabilidade biológica. Assim, é comum que ao comprar carne bovina os consumidores busquem informações adicionais de rotulagem (Bredahl, 2004). Considerando a incerteza que os consumidores apresentam na formação de expectativas e escolha da carne, informações adicionais no ponto de venda e até mesmo confiar a avaliação de qualidade a um especialista terceiro, como por exemplo açougueiros, parecem alternativas mais viáveis para auxiliar no processo de escolha (Grunert, Bredahl & Brunsø, 2004).

O aumento de incentivo para produtores diferenciarem os produtos e a comercialização dos mesmos como alimentos embalados e devidamente rotulados pode auxiliar os consumidores na escolha e a direcionar a padronização da qualidade. Obviamente essa diferenciação envolve mudança nos custos ao longo de toda cadeia produtiva e, portanto, também deve-se considerar a disposição dos consumidores brasileiros em pagar por esse tipo de produto. Nesse contexto, as indústrias produtoras de carne bovina têm o desafio não só de atender às exigências por qualidade, mas também de entender como essa qualidade é percebida pelos consumidores e as instituições governamentais têm o papel de auxiliar em diretrizes e regulamentações que viabilizem uma melhor comunicação sobre as *quality cues* da carne na rotulagem no produto.

Posto isso, o presente trabalho buscou identificar as preferências de um grupo de consumidores brasileiros ao escolher carnes bovinas com descrição de diferentes níveis de *quality cues* referentes a cor, marmoreio, raça, sabor e aroma. Para tanto, foram realizados três estudos, apresentados na forma de capítulos a seguir. O capítulo I teve como objetivo avaliar como cada *quality cue* influencia na probabilidade de compra de carne bovina crua e cozida, a disposição em pagar (WTP) e identificar diferenças no comportamento dos consumidores de acordo com o grau de envolvimento com a carne bovina. O capítulo II teve foco em avaliar como a atenção visual sobre as *quality cues* impacta na probabilidade de escolha de carne bovina crua e cozida, utilizando o equipamento *eye tracking*. Por fim, o capítulo III se concentrou em identificar os valores relevantes que fundamentaram a percepção e escolha dos consumidores após a visualização das *quality cues* no *eye tracking*. A estrutura teórica está ilustrada na figura 1 abaixo.

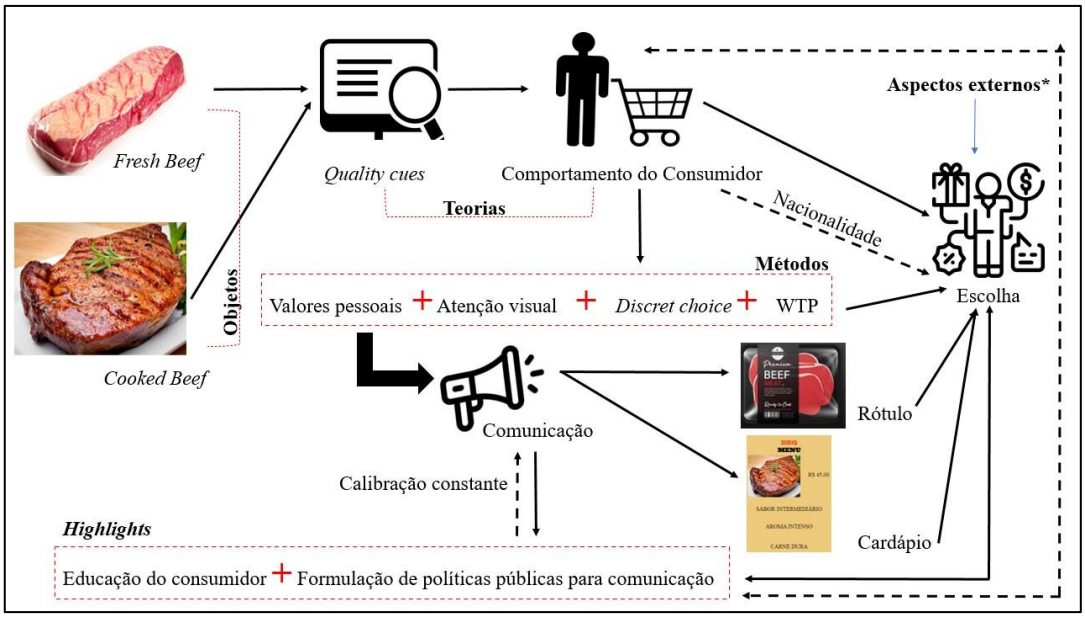

Figura 1: Elaborada pelo autor. O * inserido em "aspectos externos" se refere aos fatores extrínsecos ao consumidor e ao produto, conforme descritos por Grunert, Larsen, Madsen e Baadsgaard (1995).

O objetivo foi explorar tanto *quality cues* que são utilizadas como *claims* estratégicos pela indústria, como raça e marmoreio, quanto os aqueles que não são, como maciez e sabor e auxiliar na identificação de quais *quality cues* de carne bovina são mais relevantes e valorizadas pelos consumidores ao tomar decisão de compra, bem como destacar aquelas que poderiam ser melhor exploradas pela indústria e até mesmo regulados por órgãos fiscalizadores.

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2. SOUTHEAST BRAZILIAN CONSUMERS' INVOLVEMENT AND WILLINGNESS TO PAY FOR QUALITY CUES IN FRESH AND COOKED BEEF

Paper according guidelines of *Journal of Food Products Marketing* – published version

Abstract

This study evaluates consumer Willingness-to-Pay (WTP) according to preferences for quality-cue attributes offered in two different purchase modes: fresh and cooked meat. The questionnaire was applied and answered by 534 Brazilian meat consumers. Three clusters were defined: Group 1- price conscious consumers; Group 2- quality cues conscious consumers; and Group 3- consumers who were neither price nor quality cues conscious. Different levels of consumer involvement are related to different levels of a purchase intention regarding breed and flavor. Using a logit regression model, the probabilities regarding individual choice and WTP were then calculated. Results indicate significant differences ($p < .01$) between attributes and for both fresh and cooked beef. For fresh meat, the most important quality cue was its bright red color and the least important its marbling. Interestingly, the lowest product price level does not appear to motivate purchase intention. For cooked beef purchase, consumers highly valued tender meat with flavor and aroma. When a consumer evaluates the purchase of fresh meat, WTP starts at a low level, and then increases with the introduction of positive quality-cue attributes. The opposite is true for cooked meat, where WTP starts at a high level and then decreases as negative quality cues are introduced.

Keywords: Brazilian consumer; consumer preference; WTP; quality cues; meat quality

2.1. Introduction

There is a diverse range of factors involved in food consumption: attitudes, social-demographic factors, consumption contexts, social contexts, values, norms or social norm messages, and personal factors among them (Christie & Chen, 2018; Furst et al., 1996; Verain et al., 2021). The academic literature has presented many theories and models in this respect, offering different perspectives and insights into the phenomenon (Cadel, 2014).

Consumers are increasingly demanding when it comes to food quality, especially when one considers the agricultural, environmental, social-cultural, and economic determinants involved. In addition, consumers are concerned about food security and accessibility, and their well-being, health, and food and nutrient needs (Food and Agricultural Organization, 2012; Johnston et al., 2014). Meeting consumer expectations requires specific knowledge with respect to consumer purchase behavior and the attributes they most value. Beef can be purchased by consumers in two forms: fresh beef from meat markets and cooked beef in restaurants. In order to make better purchasing decisions, then, consumers need specific product information, known as quality cues (Saeed & Grunert, 2014), which are a combination of intrinsic and extrinsic dimensions presented to consumers, offering guidance on purchase expectation and choice (Grunert, 2006). In each purchase mode, beef presents different quality cues. For fresh beef, the main quality cues are color, marbling (Baba et al., 2016;

Killinger et al., 2004; Mwashiuya et al., 2018), and breed (Mwashiuya et al., 2018) For cooked beef they are tenderness, flavor, and aroma (Felderhoff et al., 2020; Miller, 2020; Mwashiuya et al., 2018). Price is also a factor that is significant for both purchase modes (Baba et al., 2016).

There are numerous studies in the literature focused on consumer preference for fresh or cooked meat in developed and emerging countries (Ardeshiri & Rose, 2018; Barcellos et al., 2019; Burnier et al., 2021). However, studies about fresh and cooked meat from the perspective of the same consumer are lacking. Our present study has elected to determine which quality cues are decisive when Brazilian consumers purchase beef, and how much they are willing to pay for these attributes. This could provide answers that help improve beef competitiveness in Brazil in relation to the meat of other animal species, offer better guidance for marketing campaigns and public policies, and develop improved products with higher added value.

However, beef quality cues are not equally understood among consumers. Consumers with higher product knowledge ("involvement") and who frequently purchase beef ("heavy users") are able to determine which attributes are better indicators of quality, while consumers with less experience of purchasing beef have more difficulty understanding which attributes are relevant to quality evaluation (Borgogno et al., 2015). What's more, according to the food choice modeling discussed by Christie and Chen (2018), the evaluation and choice of quality attributes may be influenced by other consumers.

The objective of this research was to set three initial goals: firstly, to evaluate how each quality cue influences the probability of beef purchase by the same consumers, based on a discrete choice model; secondly, to evaluate the influence of different consumer behavior, using an involvement scale (Verbeke & Vackier, 2004; Burnier et al., 2019b); and finally, to evaluate consumer Willingness to Pay (WTP) for beef within the context of two different purchase modes: fresh beef from meat markets and beef cooked in restaurants. In this context, we prepared a questionnaire in which meat consumers from the southeast region of Brazil, a region known for its high acquisition potential and significant consumption of beef (IBGE. Instituto Brasileiro de Geografia e Estatística, 2018), were asked about their experience of beef consumption in order to understand how beef quality cues are characterized by consumers and determine their WTP for such characteristics. The questionnaire also sought to evaluate whether people who are more involved with beef tend to evaluate meat color, marbling, breed, flavor, aroma, tenderness and price better, and if the attributes most valued by these consumers tend to increase their WTP for it.

2.2. Materials and Methods

2.2.1. Participants and data collection

As stated above, the research instrument of the current study was a structured online questionnaire, using the Google Forms platform with non-probabilistic sampling by convenience. From the authors' contact networks, participants who declared themselves as meat-eating adults, who regularly consume beef, were identified. The questionnaire was randomly distributed, by e-mail and through social networks, and potential participants were encouraged to forward the research questionnaire link to their contacts. This research methodology is in accord with Boito et al. (2021), who also interviewed a specific group of meat consumers, without inferring that the results obtained in the analysis equate to an entire population. The questionnaire was pre-tested by twenty-two consumers. This was done to check the adequacy of the vocabulary used, and to identify possible errors of interpretation as well as validation. After validation, the web link of the questionnaire was made available online during the month of April 2020. By the end of the process, a total of 534 interviews via completed questionnaires had been collected.

Data collection met every requirement of Resolution 510/16 of the National Commission for Ethics in Research (CONEP – Conselho Nacional de Saúde (National Health Council), 2016) in respect of the protection of research participants. Participants were fully briefed about the research, were aware that the information collected would be used collectively and exclusively for the purposes of the study,and understood that they could terminate their participation at any time.

2.2.2. Questionnaire

The questionnaire was structured into five different sections, with instructions given for participants at the beginning of each section (see Appendix 1). The language adopted for the questionnaire was Portuguese (native Brazilian language).

The first section of the questionnaire presented a qualifying question: "Do you habitually purchase and consume beef?" to establish whether a potential participant matched the desired research profile. Clearly, if the answer to the question was "yes," the participant could continue with the research, and if "no," participation would be automatically terminated (see Appendix 1).

The questions that followed were designed to evaluate which quality cues were most important for participant consumers, considering two different purchase modes: fresh meat and meat cooked for immediate consumption. This was done by means of the comparison of 9 products created for each purchase situation, structured through an orthogonal matrix (Rose et al., 2008).

The products were based on quality cues for fresh meat, being: color, marbling (Baba et al., 2016; Killinger et al., 2004; Mwashiuya et al., 2018), breed (Mwashiuya et al., 2018) and price

(Aboah & Lees, 2020) and on quality cues for cooked meat, being: taste, flavor, and tenderness (Delgado et al., 2006; Felderhoff et al., 2020; Miller, 2020; Mwashiuya et al., 2018) and price. For each attribute – color, marbling, breed, flavor, aroma, tenderness and price – three intensity levels were defined (Table 1), which were presented together with photographs and descriptions with the aim of guiding consumer responses (see Appendix 1).

The products created, for consumer choice according to preference, are described in Table 2 below, but were presented to consumers as given in Figures 1 and 2 (see Appendix 1).

For color, conventional and scientifically consolidated parameters for meat were established, being cherry-red, purple-red and brown. However, the participants evaluated the beef color as either bright red, dark red and brown. Three levels of more general intensity were selected for marbling (little, intermediate, much). Angus and Nellore were selected as they are the most representative breeds in Brazil.

Table 1. Quality cue levels used for product creation.

Fresh meat			**Cooked meat**			**Price**
Color	**Marbling**	**Breed**	**Flavor**	**Aroma**	**Tenderness**	**(US$)**
Bright red	Little	Angus	Weak	Weak	Tough	3.80
Dark red	Intermediate	Nellore	Intermediate	Intermediate	Tender	5.80
Brown	Much	No breed	Intense	Intense	Very Tender	9.00

Table 2. Products created for the orthogonal matrix.

Product	**Fresh meat**				**Cooked meat**			
	Color	**Marbling**	**Breed**	**(US$)**	**Flavor**	**Aroma**	**Tenderness**	**(US$)**
1	Dark red	Much	No breed	9.00	Intermediate	Intense	Tough	9.00
2	Bright red	Little	Nellore	9.00	Intense	Weak	Tender	9.00
3	Brown	Much	Nellore	5.80	Weak	Intense	Tender	5.80
4	Bright red	Intermediate	No breed	5.80	Intense	Intermediate	Tough	5.80
5	Dark red	Little	Angus	5.80	Intermediate	Weak	Very Tender	5.80
6	Bright red	Much	Angus	3.80	Intense	Intense	Very Tender	3.80
7	Brown	Little	No breed	3.80	Weak	Weak	Tough	3.80
8	Brown	Intermediate	Angus	9.00	Weak	Intermediate	Very Tender	9.00
9	Dark red	Intermediate	Nellore	3.80	Intermediate	Intermediate	Tender	3.80

Figure 1. An example of product presentation in the questionnaire, chosen according to consumer preference.

Figure 2. An example of product presentation in the questionnaire, chosen according to consumer preference.

For the attributes of flavor and aroma, more generic terms were also used when defining the levels (weak, intermediate, intense), again to facilitate consumer participant understanding. The prices were defined according to current Brazilian market values, established via an internet search.

Two hypothetical modes, as stated above, were created for participants to evaluate, both of which involved choosing from among nine (9) products presented in pairs. By this method, all the products were compared with each other. For example, product 1 was compared with product 2, product 2 compared with 3 and so on, totaling 18 questions for each purchase mode. The products were presented as “product on the left” and “product on the right”; and all the products appeared in two positions, avoiding any possible favoritism in respect of position.

For each question, participants were required to choose from three options, “neither of the products,” “product on the right” or “product on the left,” according to preference. At the end of each section participants also indicated the degree of importance of each attribute when buying and consuming meat, adapted from Burnier et al. (2019b), using the Likert seven-point scale.

Section three of the questionnaire referred to the purchase of fresh meat for a barbecue. The responder was invited to imagine that she/he was organizing a get-together with family and friends and needed to purchase pieces of sirloin steak at a place of his/her choice.

At the beginning of “Section 3 – Choosing meat for a BARBECUE” (Appendix 1), we presented the following text to evoke the idea of a real purchase occasion. “Hi! Imagine that you are organizing a barbecue for a get-together with family and friends. You need to purchase cuts of sirloin steak and, on arriving at the meat market, you discover there are 9 product options, presented in pairs. Each product includes information about meat quality cues, such as color, marbling, animal breed and price (considering the value of 1 Kg of sirloin). You are asked to choose between 3 options in the questionnaire for each product ‘PRODUCT ON THE LEFT,’ ‘PRODUCT ON THE RIGHT’ or ‘NEITHER OF THE PRODUCTS’ according to your preference, based on the meat quality cues described. There is no right or wrong choice; we only want to know what your preference is.”

On arriving at the establishment, she/he should choose, according to preference, from 18 options that included meat quality attributes such as color, marbling, animal breed and price (Figure 1).

To respond to section four, the participant had to imagine that she/he was at a restaurant commemorating a new achievement with family and friends and was responsible for choosing the sirloin steak dish cooked according to the specifications on the menu.

At the beginning of “Section 4 – Choosing meat to eat in a RESTAURANT” (Appendix 1), we presented the following text to similarly evoke the idea of a real purchase occasion. “Hi! Imagine that you are in a restaurant with your family and friends commemorating a special occasion. You are responsible for choosing the sirloin steak dish and are given a menu with 18 options. Each dish has information about meat quality cues, such as flavor, aroma, tenderness and price (considering the value of 1 Kg of sirloin). For each product, you must choose from 3 options in the questionnaire ‘PRODUCT ON THE LEFT,’ ‘PRODUCT ON THE RIGHT’ or ‘NEITHER OF THE PRODUCTS’ according to your preference for the attributes described. There is no right or wrong choice; we only want to know what your preference is.”

The menu offered 18 meat dish options with information regarding aroma, flavor, tenderness and price (Figure 2).

In the same questionnaire we also evaluated the beef purchasing and consumption profile of participants, including the frequency of weekly consumption, the values which they were prepared to pay for meat (highest, lowest and fair) and their degree of involvement with the product, evaluated by means of an involvement scale (Laurent & Kapferer, 1985; Jain & Srinivasan, 1990; Verbeke &

Vackier, 2004; Burnier et al., 2019b). This type of scale aids the search for information relevant to studies on consumer behavior. For our study, we devised the following involvement statements: “I am disappointed when I choose poor-quality meat”; “Meat is very important for me,” “I prefer meals that include meat to those that don’t”; “It is important for me that meat comes from factories properly inspected by public health authorities”; “I prefer beef to meat from other species of animal”; “I am confident that I know how to choose good-quality meat”; “I only choose meats which are source traceable.” Responses were given based on the Likert scale of 7 (seven) points, from 1 (totally disagree) to 7 (totally agree).

The objective of the final section of the questionnaire was to determine the socio-economic profile of consumers participating in the research.

2.2.3. Data analysis

For the first goal of this study, to evaluate the attributes in relation to the two different modes, at point of sale and during consumption, information obtained from the 534 interviewees was processed: a total of 9,612 pieces of information (534 participants x 18 questions for two purchase modes) to compose samples for each purchase occasion. For more details, refer to the Appendix 1. We used three types of analysis in this study: discreet choice with the logit statistical model, Involvement scale and WTP.

The study model, carried out through multiple comparisons in which consumers choose the alternative with the greatest benefit based on the attributes presented, is characterized as discreet choice. This is according to the theory of value, which states that there is a utility obtained from the component attributes of selected products (Lancaster, 1966), and to the theory of random utility, which states that unobserved variables affect choice and that utility is a construction associated with an unexplained component (Mcfadden, 1973).

For the statistical analysis of discreet choice, logistic regression (logit) was used. It is a linear model using binary dependent variables (Leon et al., 2020; Stock & Watson, 2004), which allows the probability associated with the choice or not of each product to be estimated. In our study, it is presented through a joint analysis of the meat attributes, which are given as explanatory variables.

The model is built on the cumulative logistic statistical probability function, based on equation (1; Campbell et al., 2013):

$$P_i = \frac{1}{1 + e^{-x_{i\beta}}}$$

Pi = occurrence probability of the chosen product;

Xi = explanatory variables

β = unknown parameters, to be estimated

The estimation of β parameters is based on a set of data using the maximum likelihood method, which permits a combination of coefficients to be found that maximize the probability of the sample having been observed (Torres-Reyna, 2014). After the logit model estimate, the marginal effects of each attribute are calculated, thereby finding its percentage in the choice probability variation of an individual. The model was adjusted by the R program.

For our study, a general equation was first established, including all research participants. Then, four further equations were created relating to consumers with less or more product involvement for each purchase mode. The models estimated, presented with explanatory variables, for the purchase mode of fresh meat are: BRM = Bright red meat

DRM = Dark red meat

MIM = Meat with intermediate marbling

NBM = Nellore breed meat

ABM = Angus breed meat

MP380 = Meat at a price of US$ 3.80 Kg

MP900 = Meat at a price of US$ 9.00 Kg

The models estimated, presented with explanatory variables, for the purchase mode of cooked meat are: MWF = Meat with a weak flavor

MIF = Meat with an intense flavor

MWA = Meat with a weak aroma

MIA = Meat with an intense aroma

TOM = Tough meat

TEM = Tender meat

MP380 = Meat at a price of US$ 3.80 (per dish of meat)

MP900 = Meat at a price of US$ 9.00 (per dish of meat)

The model was estimated (according to equation (1)), containing data from the two research stages, and the final model presented the estimated coefficients for the variables mentioned above.

We used an involvement scale to determine whether consumers had greater or lesser involvement with beef in each purchase mode. The level of involvement was defined according to the second question of section 2 (see Appendix 1). To measure the calculation of consumer involvement according to the purchase occasion, the Burnier et al. (2019a) scale was used, which is also in the 7-point Likert format. To determine consumers with greater and lesser involvement, the overall average was calculated for all questions on the scale of involvement, in an aggregate manner. From the calculation of the median of this aggregate average, consumers above the median were considered to be more involved and consumers below the median less involved (4.00 for fresh meat and 5.75 for cooked meat). The central data, that is values equal to the median, were disregarded for the purpose of the analysis.

The study also evaluated WTP for the different meat quality attributes (Gao & Schroeder, 2009; Janßen & Langen, 2017; Zanoli et al., 2012) in respect of fresh meat and cooked meat, as described by the products created for the orthogonal matrix. The WTP was calculated based on the works of Belluzzo Junior (1999) and Van Loo et al. (2015), wherein the value is obtained by adding the intercept and the sum of the multiplication of the coefficients estimated in the logit model, with the average values of the variables being in the sequence divided by the price estimated coefficient. The value is obtained through the sum of the intercept and the sum of the multiplication of the coefficients estimated by the logit model (Torres-Reyna, 2014), together with the median values and the division of estimated coefficient of price.

2.2.4. Cluster analysis

The research participants were grouped in clusters based on the importance attributed to each quality cue for the two purchase modes, fresh and cooked meat. The association between cluster and participant was determined by responses to questions included in the questionnaire: “How important are meat attributes (price, color, marbling and breed) at the MOMENT OF PURCHASE?” and “How important are meat attributes (price, flavor, aroma and tenderness) DURING CONSUMPTION?.”.

Through K-means clustering method, groups with similar averages were allocated to the same cluster according to the degree of similarity between purchase and consumption attributes variables (Segaran, 2007). In this way, three clusters were defined: Group 1- price conscious consumers; Group 2- quality cues conscious consumers; and Group 3- consumers who were neither price nor quality cues conscious. After defining the clusters, each group was described by their personal characteristics (Table 3).

2.3. Results and Discussion

2.3.1. Profiling of participants

A key aspect of the questionnaire was participant profiling. We included a section at the end of the questionnaire to this effect (see Appendix 1). A summary of the socio-demographic profile of participants is presented below, in Table 4.

Totaling the percentage of participants with either university graduate or post-graduate education, as an example, reveals that 52% (277 participants) have studied at this higher level. Regarding profession, the majority of participants were professionals from the food and agriculture areas, with a total of 52% (268 consumers).

Table 3. Cluster characteristics

		Price conscious (N=201) 38%	Quality conscious (N=258) 48%	Neither conscious of price nor quality (N=15) 14%
Frequency of weekly consumption	≤ ONCE A WEEK	17,00	11,00	13,00
	2 OR 3 TIMES A WEEK	37,00	44,00	36,00
	> 3 TIMES A WEEK	46,00	45,00	51,00
Gender	WOMEN	50,00	52,00	52,00
	MEN	50,00	48,00	48,00
Average income (monthly in US$)	200 TO 600	70,00	61,00	53,00
	601 TO 1.000	12,00	14,00	13,00
	>1.000,00	18,00	24,00	33,00
Age range	17-29	80,00	64,00	63,00
	>29	14,00	17,00	21,00
Profession*	AGRICULTURE AND FOOD	59,00	46,00	40,00
	OTHERS AREAS	41,00	54,00	60,00

*Note: to calculate the percentage of participants in each profession an N difference was used, in accordance with the valid responses from the questionnaire applied. N "price conscious" = 68; N "quality conscious = 116; N "neither conscious of price nor quality" = 47.

Table 4. The socio-demographic profile of participants

Information	Description	%	N
Gender	Female	51	272
	Male	49	261
Education	High School completed	48	256
	University completed	23	123
	Postgraduate	29	154
Profession	Agriculture and Food	53	282
	Other Areas	47	250
Age range	17-20	20	107
	21-29	50	267
	30-39	17	90
	> 40	13	69
Average individual income (monthly in U$$)	< 200	15	80
	200 to 600	48	256
	601 to 1,000	13	70
	1,001 to 1,400	8	42
	>1,400	16	85

The participants were also divided into age groups. As detailed in Table 4, 50% (266) of research participants were in the age group 21 to 29 years. Although 70% of consumers participating in the survey were young, which may represent a biased emphasis on youth, we believe that this

emphasis is relevant to the objective of the study, in that such participants represent the Brazilian consumers of the future.

Research participants were also questioned about the frequency of their weekly consumption of beef (Table5).

As can be seen in Table 5, most of the research participants frequently consume meat during a typical week. Adding those who consume meat between 2 and 3 times to those who consume meat 4 to 5 times a week, accounts for 75% of the total participants (399 consumers). The high frequency of weekly consumption is in accord with the study carried out in Brazil by Schlindwein et al. (2006). Additionally, high beef consumption may be due to the lower price of beef in Brazil in comparison to other countries: a result of Brazil's higher production volume.

Table 5. The weekly beef consumption frequency of the research participants

Information	**Description**	**%**	**N**
Frequency of weekly consumption	≤ once a week	14	75
	2 to 3 times a week	40	213
	4 to 5 times a week	35	186
	Every Day	11	59

Table 6. Averages and standard deviations obtained through the scale of consumer involvement with beef.

	Scale of involvement	**Average**	**SD**
1	I am disappointed when I choose poor-quality meat	5.38	1.78
2	Meat is very important for me	5.21	1.80
3	I prefer meals that include meat to those that don't	5.05	1.93
4	It is important for me that meat comes from factories properly inspected by public health authorities	4.58	2.06
5	I prefer beef to meat from other species of animal	4.54	1.97
6	I am confident that I know how to choose good-quality meat	4.25	1.76
7	I only choose meats which are source traceable	3.07	1.82

*Note: N= 534 consumers.

The research participants were also questioned about their involvement with beef, in accord with Laurent and Kapferer (1985), Jain and Srinivasan (1990), and Verbeke and Vackier (2004); Burnier et al. (2019a). The responses were scored from 1 (totally disagree) to 7 (totally agree) on the Likert scale, according to the level of consumer agreement (see Appendix 1). The results are presented in Table 6.

One significant feature of Table 6 is that the highest average score was statement 1, suggesting that most consumers agree with this statement. However, the average for statement 6 was the second lowest (4.25). This shows that, even though consumers consider they have significant involvement with beef, uncertainties might lead them to consult a third party, such as a butcher or a waiter, at the moment of choosing (Barcellos et al., 2019; Font-I-Furnols & Guerrero, 2014; Grunert et

al., 2004). Certainly, a lack of consumer experience with regard to the choice of meat can be offset by the presentation of adequate quality cues.

Statement 7 returned the lowest average, that is, the least agreement from consumers. From this it can be seen that either consumers from the southeast region of Brazil are not concerned with traceability or they do not possess enough product information to make a decision.

2.3.2. Greater or lesser product involvement

The main meat quality cues selected for the study were evaluated in terms of their relevance to purchase probability. The comparison was initially made considering the general model, and then for consumers with greater or lesser involvement according to purchase mode (Tables 7 and 8). Table 7 presents the results from the combined analysis of quality cues with tradeoffs between attributes and quality. Table 8 presents an individual analysis for each attribute, according to the importance given by consumers, as a form of validation for the results of the combined analysis.

The bright red meat color represents a 36% increased consumer purchase probability compared to the dark red meat color, which represents a 20% increased purchase probability; the brown meat color (results not presented) is given as a characteristic that decreased purchase probability. For the group with greater involvement, the bright red meat color represents the biggest impact on purchase probability, at 41% in relation to 33% for the group with less involvement.

These results are in accord with various other studies on the theme. Carpenter et al. (2001), for example, found that a bright red meat color positively influenced consumer purchase probability. Additionally, Baba et al. (2016), suggested color as one of the principle attributes that affect purchase decisions, and Troy and Kerry (2010), Banović et al. (2012), Borgogno et al. (2015), and Aboah and Lees (2020), found that consumers with greater familiarity and involvement with meat tend to see color as the principal intrinsic suggestion of quality. Clearly, color is a key attribute of visual appearance and affects purchase decisions. It is also the first meat quality cue that consumers encounter at the point of sale. In the present study, we noted that meat with a bright red color, as much for consumers with lesser involvement as those with greater involvement, increased purchase probability. However, we also noted that the biggest effect was an increase in purchase probability among consumers with greater involvement.

Table 7. The combined analysis of meat choice probability according to quality cues and product involvement.

		General (N=534)		Less involvement			More involvement		
	Variables	**Prob. Choice**	**P value**	**Prob. Choice**	**P value**		**Prob. Choice**	**P value**	
Fresh Meat	BRM	0.3686	0.0000***	0.3340	0.0000***	**N=257**	0.4162	0.0000***	**N=174**
	DRM	0.2049	0.0000***	0.1821	0.0000***		0.2326	0.0000***	
	MIM	0.0310	0.0143*	0.0470	0.0109**		0.0160	0.5156 ns	
	NBM	0.0857	0.0000***	0.0892	0.0000***		0.0840	0.0023**	
	ABM	0.0945	0.0000***	0.0448	0.0042**		0.1649	0.0000***	
	MP380	-0.1017	0.0000***	-0.0866	0.0004***		-0.1448	0.0000***	
	MP900	-0.1989	0.0000***	-0.1808	0.0000***		-0.2434	0.0000***	
Cooked Meat	MWF	-0.1654	0.0000***	-0.1898	0.0000***	**N=120**	-0.1411	0.0000***	**N=338**
	MIF	0.0530	0.0002***	0.0197	0.5575 ns		0.0751	0.0000***	
	MWA	0.0257	0.0227**	0.0419	0.1136 ns		0.0350	0.0130**	
	MIA	0.0292	0.0272**	0.0357	0.2216 ns		0.0285	0.0947*	
	TOM	-0.5966	0.0000***	-0.5820	0.0000***		-0.6053	0.0000***	
	TEM	0.0240	0.0448**	0.0053	0.8494 ns		0.0287	0.0656*	
	MP380	0.0500	0.0000***	0.0279	0.3462 ns		0.0596	0.0000***	
	MP900	-0.0600	0.0002***	-0.0923	0.0173**		-0.0315	0.1157 ns	

*p<0.10; **p<0.05 e ***p< 0.01 Prob. Choice = Choice probability. BRM= Bright red meat; DRM= Dark red meat; MIM= Meat with intermediate marbling; NBM= Nellore breed meat; ABM= Angus breed meat; MP380= Meat at a price of US$ 3,80 Kg (Fresh Meat); MP900= Meat at a price of US$ 9,00 Kg (Fresh Meat); MWF= Meat with a weak flavor; MIF= Meat with an intense flavor; MWA = Meat with a weak aroma; MIA= Meat with an intense aroma; TOM= Tough meat; TEM= Tender meat; MP380= Meat at a price of US$ 3,80 (per dish of Cooked Meat); MP900= Meat at a price of US$ 9,00 (per dish of Cooked Meat).

Table 8. An individual analysis of the importance of quality cues for consumers.

		General (N=534)		Low involvement			High involvement		
	Attributes	**Average**	**SD**	**Average**	**SD**	**N=257***	**Average**	**SD**	**N=174*****
Fresh meat	Price	5.45	1.38	5.43	1.35		5.45	1.49	
	Color	5.98	1.32	5.86	1.50		6.04	1.22	
	Marbling	4.92	1.51	4.68	1.59		5.20	1.37	
	Breed	3.57	1.71	3.13	1.62		4.11	1.7	
Cooked meat	Price	5.48	1.37	5.20	1.54	**N=120****	5.53	1.34	**N=338********
	Flavor	5.90	1.13	5.42	1.32		6.17	0.96	
	Aroma	4.77	1.43	4.38	1.59		5.07	1.31	
	Tenderness	6.42	0.98	6.09	1.32		6.55	0.81	

*N=257 refers to the lower involvement group for fresh meat; **N=120 refers to the lower involvement group for cooked meat; ***N=174 refers to the higher involvement group for fresh meat; ****N=338 refers to the higher involvement group for cooked meat.

Meat with intermediate marbling offered insignificant results in the general equation, considering $p < .01$ for groups with greater involvement. However, we noted its significance, ($p < .05$), for groups with lesser involvement, with an increase of 4% in purchase probability. These results show the relative unimportance of marbling content in the choice of products for Brazilian consumers, since,

when inserted in the model, the quantity of marbling had a negative effect (results not presented). One possible reason for these results is that Brazilian consumers are accustomed to consuming low fat beef, as the production of beef in Brazil is predominantly Nellore on pasture, resulting in meat with less marbling (Ferraz & Felício, 2010). Interestingly, our results with Brazilian consumers are different to the results of Egan et al. (2001), Ressurreccion (2004), and Aboah and Lees (2020), which unilaterally identified the effect of marbling as the best classified intrinsic suggestion. As pointed out by Ardeshiri and Rose (2018), the lower preference for this attribute may be related to a lack of knowledge about the relevance of fat content, nutritional aspects and health. Alternatively, it may be related to different cultures and eating habits.

Regarding the Nellore breed meat and Angus breed meat quality cues, both the greater and lesser involvement groups presented an increase of 8% for the probability to purchase the Nellore meat breed. Possibly, the Brazilian consumers studied had better knowledge of the Nellore breed due to its predominance in Brazilian herds and its widespread promulgation through popular media. Although the group of lesser involvement presented an increase of 4% for the probability to purchase meat from the Angus breed, the greater involvement group presented an increase of 16%. Although it has been identified in the literature that Bos indicus have innately tougher beef than Bos taurus (Highfill et al., 2012), the results in our study, based on consumer perception, may be an indication of the fact that this breed is little known by the lesser involvement group and better known by the greater involvement group and, for this reason, the contribution to purchase probability is different. The breeds need to be better known by consumers.

Studies with Chilean consumers identified breed as one of the most valued quality cues for product choice (Fernández et al., 2019). Other studies considered breed an important factor with respect to meat quality (Bernués et al., 2003; Troy & Kerry, 2010). In the present study, we found that the biggest increase in purchase probability for the Angus breed meat was within the greater involvement group and, comparing products with a specific breed to those without, consumers clearly preferred meat from an established breed (results not presented).

In terms of price, as expected, for the lowest (US$ 3.80) and highest (US$ 9.00), the probability of purchasing fresh meat differed according to involvement level. The lowest price (US$ 3.80) decreases the probability of purchase by 14% for the group with greater involvement; the highest price (US$ 9.00) reduces the purchase probability of the group with greater involvement by 24% and by 18% for the group with lower involvement. Additionally, the highest and lowest prices had negative impacts on purchase probability. Possibly a low price may indicate a perception of low quality and a high price as not having sufficient added value, or at least product quality was not perceived or valued at the point of sale.

However, the same low and high prices (US$ 3.80 and US$ 9.00), reflected different consumer behavior in terms of the purchase of cooked meat. In this case, the lowest value, which previously reduced purchase probability, increased purchase probability by 5% in the general equation

and for the consumer group with greater involvement. However, the highest price value reduced the purchase probability in the general equation by 6% ($p < .01$) and by 9% for consumers with lower involvement ($p < .05$). For cooked meat, the increase in purchase probability for the lowest-priced product may be associated with greater consumer confidence when purchasing cooked meat, and may also be related to consumer confidence in the choice of eatery.

Price may also be used as a quality cue when there is insufficient information available to evaluate a product (Merlino et al., 2018). These authors found that for consumers from the North of Italy, price was a key element and color was of secondary importance for purchase decisions. In the present study, we found that southeast Brazilian consumers saw color as a key purchase-decision quality cue for fresh meat, and tenderness as a key purchase-decision quality cue for cooked meat. It is possible that this result is because the products studied included appropriate information for consumers.

Brunsø et al. (2002) point to exasperation among meat suppliers that consumers are not willing to pay for better quality. On the other hand, consumers habitually discredit food quality, often as a result of communication failures between meat producers and consumers. The results of our study demonstrate that consumers do not necessarily choose the lowest price. This is clearly evident for the purchase of fresh meat, in which the lowest value reduced purchase probability, and may indeed be an indication that consumers are willing to pay a fair price for products. However, a fair price is not necessarily the most expensive.

For the cooked meat quality cues, weak flavor decreased purchase probability by 16% in the general equation, 19% in the group of lesser involvement and 14% in group of greater involvement; and meat with an intense flavor increased purchase probability by 5% in the general equation ($p < .05$) and 7% for the group with greater involvement ($p < .01$). These results are in accord with Brunsø et al. (2002) and Borgogno et al. (2015), who found that flavor is an important experiential characteristic, even though expectations may or may not be confirmed during consumption. One explanation for the results found is that consumers who look for the other attributes described in the questionnaire may have created a lower expectation for weak-flavored products and a higher expectation for intense-flavored products, or even may have been influenced by previous experiences.

The tenderness of meat is a very important attribute, so much so that the tough meat quality cue decreased purchase probability by 60% for the groups of both greater and lesser involvement. These results are in line with those of Font-I-Furnols and Guerrero (2014) and partially in accord with Bonny et al. (2016), who related tenderness and flavor as characteristics judged by consumers to be similar to quality. The authors found that the negative qualities of flavor and tenderness were of high relevance to the probability of purchasing cooked meat. This contrasts with the study by Merlino et al. (2018), who suggest that flavor and tenderness are less important characteristics for consumers in the northern region of Italy. Our results may indicate that southeast Brazilian consumers are reluctant to buy tough meat, due to previous undesirable purchase experiences.

As a means of validating the data obtained through the combined analysis (Table 6), at the end of sections 3 and 4 of the questionnaire (see Appendix 1) consumers gave scores from 1 (totally disagree) to 7 (totally agree), on the Likert scale, to indicate their opinions of each attribute when purchasing both fresh meat and cooked meat. These results are presented in Table 8.

By comparing averages, we can see that the highest-scored quality cues for fresh meat are color followed by price. This is true for both the greater involvement and lesser involvement groups. Furthermore, although the breed and marbling quality cues clearly show a better score in the greater involvement group, breed was the quality cue classified of least importance across the scale. These results reinforce the findings of the combined analysis (Table 6), and also demonstrate a lack of consumer knowledge about the tradeoffs offered by quality cues.

For cooked meat, the main attributes for the lesser and greater involvement groups are tenderness and flavor, respectively. For both groups, price appears as the third most important attribute, with aroma being the least important. These results also reinforce the findings of the combined analysis (Table 6).

2.3.3. Willingness to pay (WTP)

The main meat quality cues selected for the study were evaluated in the general equation of the logit model. From this equation, WTP was calculated for the two different purchase modes, fresh meat and cooked meat (Table 9). The WTP calculations reveal that when meat is defined as a base product, the initial willingness of consumers to pay for it is very low. However, as quality cues are added, this value tends to increase or decrease in different proportions, according to how the attribute is viewed by a given consumer. As consumers have different levels of involvement with meat, such differences bring varied quality perceptions and food choice standards that equally result in varying levels of WTP (Brunsø et al., 2002).

Table 9. Table with base products, to calculate the WTP of fresh meat and cooked meat.

Fresh meat			Cooked meat		
Attribute	**WTP (US$)**	**Difference (US$)**	**Attribute**	**WTP (US$)**	**Difference (US$)**
Base Product*	0.02	Base	Base Product*	17.73	Base
MIM	1.42	1.40	MWF	11.07	-6.66
BRM	21.38	21.36	MIF	20.46	2.73
DRM	12.45	12.43	MWA	19.02	1.29
NBM	4.52	4.50	MIA	19.00	1.27
ABM	5.08	5.06	TOM	0.77	-16.96
			TEM	18.86	1.13

Considering US$ 1 = R$ 5.00. *Base product = product without attributes. WTP= Willingness to pay. BRM= Bright red meat; DRM= Dark red meat; MIM= Meat with intermediate marbling; NBM= Nellore breed meat; ABM= Angus breed meat; MWF= Meat with a weak flavor; MIF= Meat with an intense flavor; MWA = Meat with a weak aroma; MIA= Meat with an intense aroma; TOM= Tough meat; TEM= Tender meat.

For fresh meat, the initial WTP is US$0.02. However, WTP increases as quality cues are added. The attribute which consumers consider increases WTP the most is bright red meat US$ 21.38, confirming the view that color is a key characteristic of meat quality for consumers (Ardeshiri & Rose, 2018). Conversely, meat with intermediate marbling US$ 1.42 lowers WTP. These results, which agree with those of Fernández et al. (2019), are possibly due to the specific eating habits of Brazilian consumers.

For cooked meat, the initial WTP is high at US$ 17.73. When the weak flavor and tough meat attributes are added, there is a reduction in WTP of US$ 6.66 and US$ 16.96 respectively. However, when the other attributes are included, there is an increase in WTP. The attribute that most contributes to a reduction in WTP is tough meat, and the attribute that most contributes to an increase in WTP is intense flavor. These results are in agreement with Gao and Schroeder (2009), who identified a change in WTP when additional information about products were offered.

Clearly, the trade-off between price and quality is an important aspect in the choice of foods by consumers. A low WTP for a certain quality does not necessarily mean a lack of interest, but does suggest a lack of knowledge regarding how the objective characteristics of products can meet subjective consumer expectations (Brunsø et al., 2002).

For cooked meats, it is also important to consider attributes that may reduce WTP, particularly tough and weak-flavored meat. In relation to attributes that increase WTP, meat with an intense flavor, meat with a weak aroma, and tender meat with an intense aroma can be highlighted.

According to Font-I-Furnols and Guerrero (2014), the location where meat is purchased is as a key factor in relation to consumer expectations. Although purchase modes were created in the current study for both cooked and fresh meat, the hedonic purchase perception shows higher evidence for cooked meat, that is, meat served in a restaurant. Hedonic quality is a characteristic experience of food, since this dimension, principally flavor, can only be established after consumption. Thus, consumers need to pre-form the hedonic quality expectations of a food product in order to make a

purchase decision (Brunsø et al., 2002). For this reason, the WTP for cooked meat has a higher initial base product value than that of fresh meat.

The WTP calculation for aroma suggests that there may be confusion on the part of consumers. This is a point of interest for restaurants and steak houses. Morquecho-Campos et al. (2020) argue that odor related to protein influences both appetite and flavor. Their results demonstrate consumer preference for protein foods, compared to other foods, due to an amenable release of aromas.

In the current study, we observed that WTP is higher for flavor and aroma when compared to tenderness. In absolute terms, the Brazilian consumers who participated in the questionnaire indicated that they would pay more to avoid tough meat, a conceptual point of view from which a preference for tender meats can be concluded. Considering this, in terms of marketing strategies, it seems to be more important to communicate to consumers that “this meat is not tough” rather than “this meat is tender.”

Our research has also identified that when consumers purchase fresh meat, the expectation created and the WTP for it is lower. After consumption, these expectations may be confirmed, exceeded or not met. However, the expectation regarding cooked meat and the WTP for it is higher. And yet, after consumption, the probability of expectations not being met may be even higher still.

2.3.4. Cluster analysis

The participants were separated into 3 clusters: price conscious, quality conscious and neither price nor quality conscious, grouped according to average proximities. Considering the total sample of 534 participants, 48% (N = 258) were allocated to the “quality conscious” cluster, 38% (N = 201) were allocated to the “price conscious” cluster, and 14% (N = 75) allocated to the “neither price nor quality conscious” cluster. These results are presented in Table 10.

Table 10. Clusters

	Questions used to group participants in clusters	Cluster		
		Price conscious (N=201) 38%	**Quality conscious (N=258) 48%**	**Neither price nor quality conscious (N=75) 14%**
1	How important are meat attributes at the MOMENT OF PURCHASE? Give a score from 1 (not important) to 7 (extremely important). [Price]	6,09	5,53	3,56
2	How important are meat attributes at the MOMENT OF PURCHASE? Give a score from 1 (not important) to 7 (extremely important). [Color]	5,81	6,48	4,49
3	How important are meat attributes at the MOMENT OF PURCHASE? Give a score from 1 (not important) to 7 (extremely important). [Marbling]	4,49	5,76	3,13
4	How important are meat attributes at the MOMENT OF PURCHASE? Give a score from 1 (not important) to 7 (extremely important). [Breed]	2,40	4,87	2,33
5	How important are meat attributes DURING CONSUMPTION? Give a score from 1 (not important) to 7 (extremely important) [Price]	6,18	5,47	3,65
6	How important are meat attributes DURING CONSUMPTION? Give a score from 1 (not important) to 7 (extremely important) [Flavor]	5,72	6,34	4,75
7	How important are meat attributes DURING CONSUMPTION? Give a score from 1 (not important) to 7 (extremely important) [Aroma]	4,40	5,45	3,35
8	How important are meat attributes DURING CONSUMPTION? Give a score from 1 (not important) to 7 (extremely important) [Tenderness]	6,49	6,74	5,13

When questioned about the importance of price at the moment of purchase (fresh meat), the group of consumers in the “price conscious” cluster, presented a greater average (6.09) compared to the other clusters. The same group when questioned about the importance of price at the moment of consumption (cooked meat) also presented a higher average (6.18) than the other groups. This demonstrates that within the quality cues studied, price was the most determining factor on the decision to purchase meat, whether fresh or cooked, for this cluster.

The consumers forming the “quality conscious” cluster attributed more importance to the quality cues of fresh meat (color = 6.48, marbling = 5.76, breed = 4.87) and cooked meat (tenderness = 6.74, flavor = 6.34, aroma = 5.45), with the exception of price. The presence of quality cues was decisive for this cluster at the moment of purchase choice.

The consumers belonging to the “neither conscious of price nor quality” cluster did not consider price or any of the other quality cues, and presented the lowest average in both situations as well as demonstrating that the quality cues made no difference to their decision to purchase.

Considering the frequency of weekly consumption, the greater proportion of consumers (17%) that consume beef at least once per week are allocated to the “price conscious” cluster, having in mind the exponential increase in the price of beef in Brazil and around the world (Hestermanna et al., 2020); a possible explanation for this result is that such consumers may opt for cheaper meats from other animal species (Zhu et al., 2021).

For the consumption frequency of 2 to 3 times per week, the greater proportion (44%) is allocated to the “quality conscious” cluster, and those who consume beef more than 3 times a week have the greatest percentage (51%) allocated to the “neither price nor quality conscious.” A possible explanation for this latter result might be indecision at the moment of purchase, since such an individual does not consider price or other quality cues as a determining factor of choice. Another possible explanation is the lack of standardization of meat cuts in retail outlets, in so much as that even an individual who frequently consumes meat and, consequently, frequently purchases it, has choice difficulties. Further studies are required to better understand the issues involved.

Regarding gender, the proportion of men and women were similar across the clusters.

A significant proportion (70%) of consumers with a lower monthly salary, US$ 200.00 to US$ 600.00 was allocated to the “price conscious” cluster. This result makes sense, since a lower monthly income inevitably means that price is an important deciding factor for purchase choice (Zhu et al., 2021).

Taking the age of participants into consideration, the age group 17–29 had a greater representative allocation (80%) in the “price conscious” cluster. Bearing in mind that, generally, this age group is at the outset of a career lower salary range is one possible explanation.

The professions in which consumers worked were separated into agriculture or food and other areas. This division sought to bring together professionals who have technical information with respect to animal production (agriculture) and food. Around 60% of the participants working in other professional areas were allocated to the “neither price nor quality conscious” cluster. A possible explanation for this could be choice difficulties arising from the lack of standardization of meat cuts and no clear quality indicators to guide the food choices of purchasers. Further studies are needed.

2.4. Conclusion

The lack of consumer knowledge regarding quality cues, demonstrates the need to improve communication between the production sector and consumers, seeking to improve customer service and involvement with beef, whether in its fresh state or cooked for immediate consumption. Our

results offer meat processors and retail outlets suitable indicators for quality cues that help consumers make informed choices about the products made available to them, indicators which could help to reduce doubts arising at the moment of purchase. We have identified, for example, that there are quality cues that increase purchase probability for fresh and cooked meat, such as bright red color and intense flavor, respectively. Information related to these attributes may be better explored on product labels used in retail stores, making use of beef quality guarantee labels or other such substantive claims.

As well as the difference found in the levels of attributes, we found that the perception of value and valorization of the attributes described vary according to the degree of consumer involvement. In this case, establishments that commercialize fresh and cooked meat should ensure that communication is focused on their target public.

The lack of official and consumer understandable quality cues information regarding breed for fresh meat and information and quality cues regarding tough for cooked meat could be an investment opportunity for government agencies, certification companies, restaurants, butchery and meat industries.

Our results suggest that the all players from meat value chain could explore three different segments of consumers. Meat brands could position their products with different quality cues for the same groups of segments. The same or others segments could be found in different markets. For instance, price sensitive segments could be a group that only exist in non-developed countries.

Our results also suggest that consumers are willing to pay a fair price for the perception of meat quality. However, further studies would clearly contribute to a better understanding of the purchase behavior of consumers of fresh and cooked beef in other regions, analyzing the varying cultural aspects of such regions in particular. Other types of meat that are fresh and cooked purchase could be evaluated by their quality cues.

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Appendices

Appendix A. Questionnaire with beef consumers

Section 1

Do you habitually purchase and consume beef?

a. Yes
b. No

Section 2 – Profile for the purchase and consumption of beef

How many times a week do you consume beef?

a. Less than once a week
b. 2 to 3 times a week
c. 4 to 5 times a week
d. Every day

For each statement below, score from 1 (not important) to 7 (extremely important)

	1	2	3	4	5	6	7
Meat is very important for me							
I prefer meals that include meat to those that don't							
I prefer beef more than meat from other species of animal							
I am disappointed when I choose poor-quality meat							
I am confident that I know how to choose good-quality meat							
I only choose meats which are source traceable							
It is important for me that meat comes from factories properly inspected by health authorities							

How much are you prepared to pay (R$) for 1 Kg of sirloin steak? Give the HIGHEST value.

How much are you prepared to pay (R$) for 1 Kg of sirloin steak? Give the LOWEST value.

How much are you prepared to pay (R$) for 1 Kg sirloin steak? Give a FAIR value.

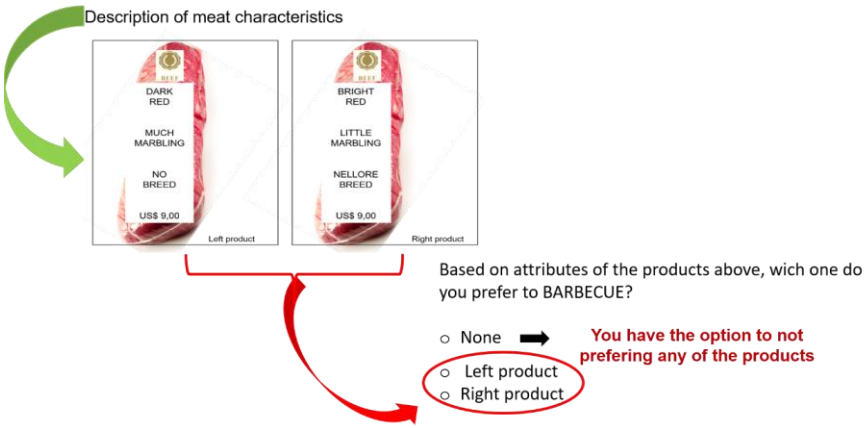
Section 3 – Choosing meat for a BARBECUE

Hi! Imagine that you are organizing a barbecue for a get-together with family and friends. You need to purchase cuts of sirloin steak and on arriving at the meat market you discover there are 18 product options, presented in pairs. Each product includes information about meat quality cues, such as color, marbling, animal breed and price (considering the value of 1Kg of sirloin).

You are asked to choose between 3 options for each product "PRODUCT ON THE LEFT", "PRODUCT ON THE RIGHT" or "NEITHER OF THE PRODUCTS" according to your preference,

based on the meat quality cues described. There is no right or wrong choice; we only want to know what your preference is.

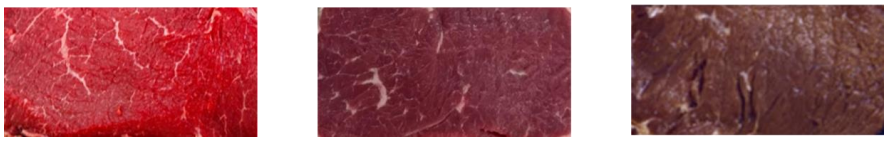
Follow the guidance instructions below.



Color

Can be seen on the surface of meat.

Bright red | Dark red | Brown



Marbling

It's fat that is in middle of meat.

Little marbling | Intermediate marbling | Much marbling

Breed

Animals with similar characteristics

No breed	Nellore breed	Angus breed
No defined origin	Indian origin	Scottish origin
Undefined rusticity	More rustic breed	Less rustic breed
Indefinite heat tolerance	High heat tolerance	Low heat tolerance
10% of total cattle in Brazil	80% of total cattle in Brazil	10% of total cattle in Brazil

Price

Value attibuted for purchase of 1 Kg of meat

Lowest price	Intermediate price	Highest price
US$3,80	**US$5,80**	**US$9,00**

Carefully read the product attributes and respond to the following question:

Based on the product descriptions above, which do you prefer for a BARBECUE?

a. Neither of the products
b. Product on the left
c. Product on the right

Carefully read the product attributes and respond to the following question:

Based on the product descriptions above, which do you prefer for a BARBECUE?

a. Neither of the products
b. Product on the left
c. Product on the right

Carefully read the product attributes and respond to the following question:

Based on the product descriptions above, which do you prefer for a BARBECUE?

a. Neither of the products
b. Product on the left
c. Product on the right

Carefully read the product attributes and respond to the following question:

Based on the product descriptions above, which do you prefer for a BARBECUE?

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Based on the product descriptions above, which do you prefer for a BARBECUE?

a. Neither of the products
b. Product on the left
c. Product on the right

Carefully read the product attributes and respond to the following question:

Based on the product descriptions above, which do you prefer for a BARBECUE?

a. Neither of the products
b. Product on the left
c. Product on the right

Carefully read the product attributes and respond to the following question:

Based on the product descriptions above, which do you prefer for a BARBECUE?

a. Neither of the products
b. Product on the left
c. Product on the right

Carefully read the product attributes and respond to the following question:

Based on the product descriptions above, which do you prefer for a BARBECUE?

a. Neither of the products
b. Product on the left
c. Product on the right

Carefully read the product attributes and respond to the following question:

Based on the product descriptions above, which do you prefer for a BARBECUE?

a. Neither of the products
b. Product on the left
c. Product on the right

What is the importance of the following meat quality cues at THE POINT OF SALE? Score from 1 (not important) to 7 (extremely important).

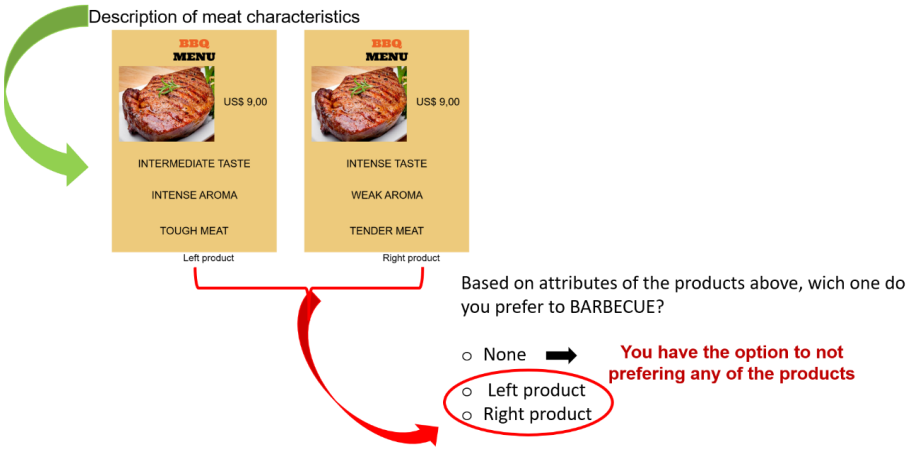
Quality cues	1	2	3	4	5	6	7
Color							
Marbling							
Breed							
Price							

Section 4 – Choosing meat to eat in a restaurant

Hi! Imagine that you are in a restaurant with your family and friends commemorating a special occasion. You are responsible for choosing the sirloin steak dish and are given a menu with 18 options. Each dish has information about meat quality cues, such as taste, aroma, tenderness and price (considering the value of 1Kg of sirloin).

You must choose from 3 options for each product "PRODUCT ON THE LEFT", PRODUCT ON THE RIGHT" or "NEITHER OF THE PRODUCTS" according to your preference for the characteristics described. There is no right or wrong choice; we only want to know what your preference is.

Follow the guidance instructions below.



Taste

Meat property in stimulating the palate after consumption

Aroma

Odor released from meat after preparation

Tenderness

Meat texture perceived when chewing

Price

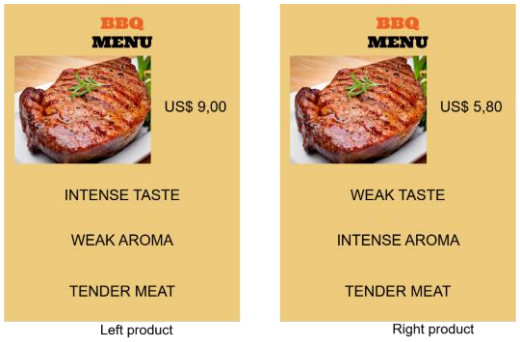
Value in R$ paid for a meat plate

Carefully read the product attributes and respond to the following question:

Based on the product descriptions above, which do you prefer for a BARBECUE?

a. Neither of the products
b. Product on the left
c. Product on the right

Carefully read the product attributes and respond to the following question:



Based on the product descriptions above, which do you prefer for a BARBECUE?

a. Neither of the products
b. Product on the left
c. Product on the right

Carefully read the product attributes and respond to the following question:

Based on the product descriptions above, which do you prefer for a BARBECUE?

a. Neither of the products
b. Product on the left
c. Product on the right

Carefully read the product attributes and respond to the following question:

Based on the product descriptions above, which do you prefer for a BARBECUE?

a. Neither of the products
b. Product on the left
c. Product on the right

Carefully read the product attributes and respond to the following question:

Left product

Right product

Based on the product descriptions above, which do you prefer for a BARBECUE?

a. Neither of the products
b. Product on the left
c. Product on the right

Carefully read the product attributes and respond to the following question:

Left product

Right product

Based on the product descriptions above, which do you prefer for a BARBECUE?

a. Neither of the products
b. Product on the left
c. Product on the right

Carefully read the product attributes and respond to the following question:

Left product

Right product

Based on the product descriptions above, which do you prefer for a BARBECUE?

a. Neither of the products
b. Product on the left
c. Product on the right

Carefully read the product attributes and respond to the following question:

Left product

Right product

Based on the product descriptions above, which do you prefer for a BARBECUE?

a. Neither of the products
b. Product on the left
c. Product on the right

Carefully read the product attributes and respond to the following question:

Left product

Right product

Based on the product descriptions above, which do you prefer for a BARBECUE?

a. Neither of the products
b. Product on the left
c. Product on the right

What is the importance of the following meat attributes DURING CONSUMPTION? Score from 1 (not important) to 7 (extremely important)

Quality cues	1	2	3	4	5	6	7
Taste							
Aroma							
Tenderness							
Price							

Section 5 – Socio-econômic Profile

Age (in years).

Gender

a. Female
b. Male
c. Prefer not to say

Educational Level

a. Elementary School (completed)
b. High School (completed)
c. Studying Higher Education
d. Higher education (completed)
e. Post-Graduation (completed)

What is your profession? (Students, please give the name of your course).

In which municipality do you live?

What is your monthly income?

a. < US$ 200.00
b. From US$ 200 to US$ 600
c. From US$ 601 to US$ 1.000
d. From US$ 1.001 to US$ 1.400
e. > US$ 1.401

3. IS VISUAL ATTENTION A KEY DETERMINANT OF CONSUMER PURCHASE OF FRESH AND COOKED BEEF?

Paper according guidelines of *Journal of British Food* – submission version

Abstract

Purpose: Investigate existing visual attention literature that examines concepts of quality and visual cues which are applicable to fresh and cooked beef and evaluate how visual attention impacts the probability of choice by a sample of Brazilian beef consumers.

Design/Methodology/Approach: Eye-tracking equipment was used to collect visual attention data and the discrete choice method was used for experimental design.

Findings: Consumers in the sample studied demonstrated that some visual cues directly affect the probability of choosing either fresh or cooked beef.

Originality: Propose an analytical model to determine how visual cues of beef affect the probability of consumer choice.

Implications of Research: We aim to contribute to the literature on visual cues according to a sample of Brazilian consumers. We will propose strategies for altering packaging design strategies and provide information and communication on beef attributes.

Limitations: Our findings are limited to a small sample of consumers from the southeast Brazil region. Studies with larger consumer samples from different regions of the country are recommended.

Keywords: Brazilian consumer, Meat quality, Beef, Consumer behaviour, Visual attention, Eye-Tracking

3.1. Introduction

A consumer typically makes a purchase choice of beef at the point of sale and, in most cases, visual information and specific beef attributes are the main way of evaluation that determines the probability of its choice or rejection (Bialkova et al., 2020). Beef attributes are assigned based on quality and visual cues, which provide product information and assist consumers in evaluation, creation of expectations and decision-making (Grunert et al., 1995). For raw beef (fresh beef), quality and visual cues are usually present in the labelling of products, while for cooked beef information is available on menus or provided by waiters. Thus, it is important to understand how visual information about beef quality is perceived and how it interferes with the probability of choice.

In a study conducted with Brazilian consumers, Malheiros et al. (2022) found that for fresh beef, a bright red colour increased the probability of purchase, and is the most important characteristic of raw beef. For cooked beef the same authors found that tough meat reduced both the probability of

choice and the willingness to pay, demonstrating that tough beef is an undesirable quality and is important in decision-making.

The literature suggests that visual attention is widely applied to food products (Peng-li et al., 2020; Kim et al., 2020; Leon et al., 2020; Bialkova et al., 2020; Manippa et al., 2019; Helmert et al., 2017; Siegrist et al., 2015; Rebollar et al., 2015) and aims to help in understanding which visual qualities are most important during the process of choosing food and how they contribute to an increased or reduced probability of choice. Previous studies on the visual attention of consumers of beef have been carried out (Banović et al., 2016), however, there is a lack of studies on Brazilian consumers.

This study aimed to evaluate the effect of visual attention on the purchase probability of beef in a sample of Brazilian consumers exposed to visual stimuli of products with various combinations of visual or quality cues in two purchasing situations: 1- fresh and 2- cooked beef. We also aimed to propose a new statistical approach to evaluate eye-tracking results.

The use of eye-tracking for this study brings objectivity and precision to the measurement of non-conscious metrics, allowing us to evaluate changes in purchasing behaviour motivated by visual attention. Participants were not questioned directly, but rather had their eye movement and visual attention measured with equipment. This mimics real-world behaviour and is crucial to help in understanding how consumers observe and mark their choices from the visual cues available (Graham et al., 2012).

3.2. Literature Review

3.2.1. Visual attention for food

Vision is the most used sense during the process of buying food (Rebollar et al., 2015 and Fenko et al., 2010) because consumers need to visualize information before they can use it in the selection process (Siegrist et al., 2015). Visual attention broadly represents the cognitive process of understanding specific visual information and demarcating these into areas of interest (AOI) (Duarte et al., 2021; Bialkova et al., 2020; Hernandez et al., 2017 and Duchowski, 2007). Visual attention is understood to be the first stage of a series of processes that influence consumer choice (Mundel et al., 2018).

The attention given by consumers to a stimulus is selective and can be presented in the following two ways: bottom-up, in which attention is directed to stimuli, and top-down, which is related to the objectives of the observer (Pentus et al., 2020 and Leon et al., 2020). The bottom-up situation occurs when a stimulus stands out in the visual field, that is, attention is guided by visual characteristics, such as the size, colour, and shape of a stimulus or internal characteristics of stimuli that automatically capture the attention of individuals (Boardman and Mccormick, 2022; Manippa et

al., 2019; Bialkova et al., 2013 and Navalpakkam et al., 2012). Bialkova et al. (2020) explored the behaviour of the appearance and purchasing decisions made by consumers for cereal bars of different brands and flavours. They found that the brand and variety of the product were key determinants in driving consumer attention and suggest that where there is greater attention given to a brand, there is a higher probability of choice. Peschel et al. (2019), evaluated the effect of visual attention on product labels on chocolates, yoghurt, and tomato with the organic symbol in different sizes. They found that the use of bottom-up effects to improve the design and visibility of this information increased attention capture as well as the probability of product choice.

Conversely, top-down attention occurs when consumers focus on stimuli that are in line with their goals, expectations and even their emotions (Boardman and Mccormick, 2022; Bialkova et al., 2011; Scott and Hand, 2016; Imamoglu et al.; 2018). Ares et al. (2013) evaluated how consumers perceive the healthiness of mayonnaise, bread, and yoghurt, as well as their willingness to buy, and found that consumers directed visual attention to specific information such as ingredients and nutritional information. Banović et al. (2016) studied the effect of beef fat content on visual attention and purchase choice and found that consumers pay more attention and more often choose beef with lower fat content due to the perception of healthiness. According to Van der Laan et al. (2017), specific objectives can focus on visual attention and food choice.

When observing a stimulus, the consumer's eye movements can be measured with eye-tracking equipment, which allows accurate recording of periods and fixation sites. Literature suggests that consumers process AOI information with fixations on specific attributes. Alternations between these fixations, e.g., colour and size, are called saccades. Fixations are the periods of attention given to an area of interest, characterized by periods of discrete immobility of the eye while the information is visualized and processed before looking for another AOI. Although it is understood that the view is suppressed during the saccades, they are useful to reveal elements of the consumer's visual search, such as trade-offs and the order seen in the AOI (Leon et al., 2020, Rayner, 1998, Rayner, 2009). In the present study, the AOIs contemplate information on quality and visual cues based on colour, marbling, breed, flavour, tenderness, and aroma of beef.

The main parameters of visual attention contemplated in the present study are: a) Time of the first fixation: reflects the time it takes the consumer to process information of an AOI for the first time. In general, information that is more complex for the consumer takes longer to be visualized, so the shorter the time for the first fixation, the greater the ability of information to capture visual attention; b) Total fixation time: indicates the total time of fixing on an AOI throughout the stimulus. Long fixations may indicate that the consumer has difficulty in interpreting the information presented; c) Number of fixations in an AOI (number of looks): refers to the total number of fixations on a specific attribute or area of interest. The more a consumer fixes on an attribute of interest, the more importance the consumer places on this, e.g., colour (Muñoz-Leiva et al., 2021; Colorado et al. , 2015; Barreto, 2012).

The information contained in the food itself is an important communication channel that directs how visual attention and consumer choices will be affected (Fenko et al., 2018; Banović et al., 2016). To explore consumer behaviour and increase the probability of choosing a food, it is important to understand which elements can effectively capture their attention (Bialkova et al., 2020; Rebollar et al., 2015; Ares et al., 2013). Thus, eye-tracking is used to measure which stimulus information has the shortest time for the first fixation, the path taken by the eye, total fixation time, the percentage of areas fixated on and the quantity of fixations (Leon et al., 2020, Mundel et al., 2018, Sousa, 2016, Huang and Kuo, 2011).

Studies focusing on the visual attention of Brazilian consumers have previously been conducted (Silva et al., 2023; Jacintho et al., 2020 and Mundel et al., 2018), however, they focused on other products than beef. As such, the current study aims to contribute novel data that can assist private and government institutions to explore which quality and visual cues more are responsible for the visual attention of consumers. Using this information, we can design strategies to increase the probability of choice, and gain insights for future research.

3.2.2. Quality and visual cues for food

The quality of a product may have an impact on the food choice process, but only if it is perceived (Grunert, 2006). The visualisation of quality cues is necessary for understanding and used at the time of choosing a food product since the first sensory contact of the consumer with food is through the eyes (Wadhera and Capaldi-Phillips, 2014). Thus, before food is effectively chosen by the consumer, visual attention is directed to visual cues, which provide information about the characteristics of food through words, images, symbols, or the appearance of the product (Wadhera and Capaldi-Phillips, 2014; Imram, 1999).

Consumers make purchasing decisions based on intrinsic and extrinsic visual cues that they correlate to specific attributes based on prior experience and credibility (Aboah and Lees, 2020). Intrinsic visual cues are inherent to the food itself and cannot be manipulated without affecting its physical properties – these include appearance, taste, and texture. Extrinsic visual cues are related to the product and include labelling, packaging, marketing information or situational contexts. (Chonpracha et al., 2020). Regarding beef, the main intrinsic visual cues reported are cut, colour, fat content, flavour, tenderness, and taste (Aboah and Lees, 2020; Ballco and Gracia, 2020; Morquecho-Campos et al., Boesveldt, 2020; Strydom et al., 2019; Wijk et al., 2019; Fernández et al., 2019; Sonoda et al., 2018; Borgogno et al., 2015). Extrinsic visual cues represent all the other product characteristics, such as brand, price, packaging, origin, and information regarding animal production (Morquecho-Campos et al., 2020; Meyerding et al., 2018; Troy and Kerry, 2010).

Exposure to visual cues can promote variations in consumption, acceptance, visual attention, and the creation of expectations by the consumer (Wadhera and Capaldi-Phillips, 2014), which can have a halo effect, modifying the perception of flavour and acceptability of food. In this sense, visual properties are critical for holding visual attention and swaying the choosing of products sold by their own appearance, and not by the packaging design. According to previous studies, foods marketed by their own appearance stand out by visual cues of colour, texture and the perception of flavour stimulated by colour (Imram, 1999). Regarding beef, studies have shown that the acceptance of beef with information highlighting a dark red colour is higher compared to those with a bright red colour (cherry red) (Holman et al., 2016 and Jackman et al., 2010). Additionally, Chonpracha et al. (2020) found that intrinsic and extrinsic visual cues significantly influence consumer emotions, hedonic perception and even food purchase intention. These authors found that when purchasing salads, consumers preferring a certain intrinsic visual moderated the effect that extrinsic visual cues had on the process of choosing, i.e., the provision of additional information about the food, such as names or information on the packaging, can increase the choice and probability of purchase.

From a Brazilian perspective, the main visual cues of beef presented to consumers at points of sale can be divided into two groups: a) regulated: mandatory labelling information by governmental agencies, such as beef cut name, manufacturer name, expiration date, etc.; and b) strategic: explored in the form of claims or seals by private initiatives.

When buying fresh beef in Brazil, consumers can purchase from one of three situations: meat available in butcher shops and packed according to the consumer's request, chilled meat cuts and vacuum-packed meat (Barcellos et al., 2019). When purchasing from a butchery or as chilled meat, the consumer has little extrinsic information available about the product – there is a focus mainly on price and visual cues such as appearance. On the other hand, vacuum-packed meats are labelled with regulated visual cues for packaged products, namely: weight, origin, federal inspection seal, product preservation, brand, batch identification, manufacture date, expiration date, and registration number (Brazil, 2005); and strategic visual cues, such as breed, premium quality seals, livestock system, age, among others.

When purchasing cooked beef (in a restaurant), there are two main options available: A la carte dishes prepared with specific beef cuts or all-you-can-eat buffets with various types of meats and beef cuts (Chow et al., 2007). In both cases, consumers are provided with specific information on price, regulated visual cues and strategic visual cues, such as animal breed. Usually, additional information can be obtained from the waiter or even from the appearance and aroma of the meat.

Visual cues of food are determinant in the food choice process however, the way foods are presented to consumers is not standardised. For beef, the type of visual cue available to consumers varies according to how they are presented at the point of sale, whether the beef is raw or cooked and the strategy of each private company, through the communication of claims, for example. Previous studies on visual attention attempted to use such data to estimate the amount of consumption, eating

behaviour, reward process, stimulation of healthy consumption and reducing obesity, differences in dietary perceptions between generations and effect of expanding areas of exposure to increase sales (Vermeir and Roose, 2020; Hallez et al., 2020; Coucke et al., 2019; Kunz et al., 2019; Kuster et al., 2019; Doolan et al., 2014, Wadhera et al., 2014; Scheibehenne et al., 2010). However, few studies have focused on the contribution of visual attention to the probability of choice (Conpracha, 2020), and studies focusing on beef are scarce.

3.3. Materials and Methods

3.3.1. Research data

The study was conducted in the city of Piracicaba (São Paulo, Brazil) in December 2020, with 23 participants. The participants were randomly selected from the researchers' contact network and through recommendations from other participants. All individuals who participated in the research reported consuming and buying beef at least once a week. The study was conducted in person, with a scheduled time to avoid large groups, in an open space and respecting the World Health Organization (WHO) and local authorities' protocols to prevent Covid-19. Data collection addressed all the requirements of Resolution 510/16 of the National Commission for Research Ethics (CONEP, 2016) regarding the protection of research participants and was approved by the Ethics Committee on Research with Human Beings of ESALQ/USP, the researchers' institution.

In the experimental space, the participants were given eye-tracking equipment and directed towards an online questionnaire that aimed to collect socioeconomic and consumer behaviour data.

3.3.2. Visual attention – eye tracking

The study presented consumers with nine hypothetical products to choose from according to the protocol of Malheiros et al. (2022). Two purchase situations were used for fresh and cooked beef, and a combination of information on visual cues including colour, marbling, breed, tenderness, flavour and aroma, in order to evaluate whether visual attention interferes with the probability of consumer choice.

Two different visual stimuli were created to represent hypothetical products to consumers, a vacuum-packed striploin representing fresh beef and a dish with striploin steak representing cooked beef. The attributes were inserted directly into the images with the same spacing, font size and image, mitigating the risks of interference in the readability of the information. Each product was compared by occupying the right and left positions to avoid favouring visual field position and a total of 18 visual stimuli were presented in each purchasing situation. After visualizing the stimulus, the

consumer had to indicate which product was their choice ("product on the right", "product on the left" or "none of the products".

All visual stimuli were presented to participants on Microsoft® PowerPoint® with standard slide (4:3) maximized and used eye-tracking equipment (Tobii T120) with an integrated monitor, on a 17" screen with a resolution of 1280 x 935 pixels and full-screen adjustment. Before starting the presentation of the images to consumers, the equipment was calibrated for each participant, considering equipment distance and height, to ensure better capture of the field of vision. Calibration was performed according to the manufacturer's recommendations.

The images were displayed in sequence and the transition time was 10 seconds. Amongst the transitions, there was a black background image, with the aim of "cleaning the image" and preparing the consumer for comparison with the following products. Before being presented to consumers the areas of interest for capturing visual attention in the images were marked around the quality cues studied, with the geometric shape of identical areas for all attributes, according to figures 1A and 1B.

FIGURES 1A and 1B: Areas of interest demarcated for Fresh and Cooked beef, respectively.

414 observations were collected from the 23 participating consumers (23 participants x 18 questions = 414 observations) for each situation. These data were initially used as variables of a Logit regression model, making it possible to find their effects on the choice of the visualized product.

3.3.3. Data analysis – logit model

Logistic or logit regression is used as a nonlinear model designed specifically for binary dependent variables (Malheiros et al. (2022)). This regression allows estimation of the probability associated with the occurrence of a given event, considering a set of explanatory variables (Stock and Watson, 2004) and aims to understand the differences between certain groups and the probability that an individual, or group, must belong to a certain category (Ulkhaq et al, 2018).

Thus, for the fresh beef model:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_{17} X_{17} + u_t \quad \text{(xx)}$$

Y is the binary variable where Y=1 characterizes the consumer who chose the product (right or left) of the stimulus visualized in fresh beef; Y= 0 characterizes the consumer who chose neither the product on the right nor the product on the left of the slide; $\beta_0, \beta_1, \beta_2, \ldots, \beta_{17}$, are the parameters of the model to be estimated (coefficients) and ut refers to the term of stochastic error. The values assumed by X are described below:

X_1 = "FRE.PRICEi", price that the participant would be willing to pay for the beef visualized in the stimulus, assuming values of US$ 3.80, US$ 5.80 and US$ 9.00;

X_2 = "FRE.BROWNCO", brown-coloured beef, assuming value 1 when the beef visualized by the participant has a brown colour and value 0 when the beef has dark red or bright red colour;

X_3 = "FRE.FBRIGHTCO", total time (seconds) of the first fixation in the AOI, related to the stimulus of beef with bright red colour;

X_4 = "FRE.FBROWNCO", total time (seconds) of the first fixation in the AOI related to the stimulus of the beef with brown colour;

X_5 = "FRE.TDARKCO", total time (seconds) of fixation in the AOI related to the stimulus of beef with dark red colour;

X_6 = "FRE.TNELLOREB", total time (seconds) of fixation in the AOI related to the stimulus of beef from animals of the Nellore breed;

X_7 = "FRE.TWITHOUTB", total time (seconds) of fixation in the AOI related to the stimulus of beef without any breed information;

X_8 = "FRE.TBROWNCO", total time (seconds) of fixation in the AOI related to the stimulus of beef with brown colour;

X_9 = "FRE.VDARKCO", number of times that the individual fixates on the AOI related to the stimulus of beef with dark red colour;

X_{10} = "FRE.VSMALLMAR", number of times that the individual looks at the AOI related to the stimulus of beef with small marbling;

X_{11} = "FRE.VMODERATEMAR", number of times that the individual looks at the AOI related to the stimulus of beef with moderate marbling;

X_{12} = "FRE.VABUNDANTMAR", number of times that the individual looks at the AOI related to the stimulus of beef with abundant marbling;

X_{13} = "FRE.VPRICE380", number of times that the individual looks at the AOI related to the stimulus of beef price of US$ 3.80;

X_{14} = "FRE.VWITHOUTB", number of times that the individual looks at the AOI related to the stimulus of beef without breed information;

X_{15} = "FREQCONS_C", frequency of beef consumption in the week, assuming value 1 when consumption is 4 to 5 times a week and value 0 when otherwise;

X_{16} = "FREQPURCHASE_D", frequency of purchase of beef in the month, assuming value 1 when the frequency of purchase is 6 or more times per month and value 0 when otherwise;

X_{17} = "MED_COMP", average of the scores assigned by the participants during the product choice experiment. These scores[1] refer to information on comparisons of knowledge of the general population with the interviewed consumer.

For the cooked beef model, the values assumed by X are described below:

X_1 = "COO.PRICE", price that the consumer would be willing to pay for the beef visualized in the stimulus, considering values of US$ 3.80, US$ 5.80 and US$ 9.00;

X_2 = "COO.FREQCONS_B", frequency of beef consumption in the week, assuming value 1 when consumption is 2 to 3 times a week and value 0 when otherwise;

X_3 = "COO.FREQPURCHASE_D", frequency of buying beef in the month, assuming value 1 when the purchase is 6 or more times per month and value 0 when otherwise;

X_4 = "COO.TOUGHMC", toughTough beef, assuming value 1 when the beef visualized by the consumer is tough and value 0 when otherwise (tender or very tender beef)

X_5 = "COO.FTOUGH", total time (seconds) of the first fixation in the AOI related to the stimulus of tough beef;

X_6 = "COO.FWEAKFLAVOUR", total time (seconds) of the first fixation in the AOI related to the stimulus of beef with weak flavour;

X_7 = "COO.VPRICE580", number of times that the individual visits the product and fixates on the AOI related to the stimulus of beef price of US$ 5.80;

X_8 = "COO.VPRICE900", number of times that the individual visits the product and fixates on the AOI related to the stimulus of beef price of US$ 9.00;

X_9 = "COO.VINTENSEFLAVOUR", number of times that the individual visits the product and fixates on the AOI related to the stimulus of beef with intense flavour.

The data related to the variables of the two models (Fresh and Cooked Beef) were considered significant when $p<0.05$. The analyses of the models were based on the evaluation of the marginal effect provided by the coefficients of the explanatory variables on the dependent variable. Other models were estimated considering the presence of other variables, using a stepwise method and with the aid of the lowest value for the Akaike Information Criterion (AIC), the most robust model (best statistical adjustment) was defined for each stage. The lower the AIC, the better the fit of the model (Wooldridge, 2009; Hair et al. 2009). The AIC is calculated as follows:

$$AIC = -2\,log\,log\left(L_p\right) + 2[(p+1)+1] \quad \text{(xx)}$$

where Lp is the function of maximum probability and p is the number of explanatory variables of the model.

A way to evaluate the adjustment of logistic regression to data is to use Pseudo R-Squared. They play a similar role like R^2 in linear regression, by representing the proportion of variation that

occurred in the dependent variable that is explained by the model (Hair et al 2009). These values can also be used to compare the performance of competing models, between two equally valid logistic equations. For this, the one with the highest Pseudo-R^2 should be chosen.

3.4. Results and Discussion

3.4.1. Participants profile

The participant's profile was obtained by data collection via online surveys (Table 1).

Table 1. Socioeconomic profile of participants.

Information	Description	%	N
Frequency of weekly consumption	Once a week	13%	3
	2 or 3 times a week	61%	14
	4 or 7 times a week	26%	6
Frequency of month purchase	Once a month	9%	2
	2 or 3 times a month	52%	12
	4 or 5 times a month	22%	5
	6 or more time a month	17%	4
Gender	Male	57%	13
	Female	43%	10
Age range (years)	18-30	74%	17
	31-40	26%	6
Education	High School completed	13%	3
	University completed	57%	13
	Postgraduate	30%	7
Average income (month)	US$ 200.00 - US$ 600.00	61%	14
	US$ 601.00 - US$ 1000.00	26%	6
	US$ 1.001.00 - US$ 3000.00	13%	3
Location	São Paulo	96%	22
	Others	4%	1

The most prominent participants included men aged 24 to 30 years, with a college degree, minimum frequency of purchase of 2 times a month, and weekly consumption of beef being 2 to 3 times a week, living in the state of São Paulo, Brazil, and with a salary ranging from US$ 200.00 to US$ 600.00 dollars, which corresponded to approximately 22% of the research participants.

3.4.2. Visual attention – fresh beef

The results obtained from the Logit model for Fresh and Cooked Beef are presented in Tables 2 and 3, respectively. When comparing the predicted values obtained with the estimated models for fresh beef to the observed values of the sample, we obtained an accuracy index of 95.19%, which is considered a good fit, according to Pino (2007).

Table 2. Estimates of *Logit* model coefficients for Fresh Beef and respective values of marginal effects.

Variables	Coefficients	Standart desviation	*p*-valor	MgE#
Intercepto	17,359	4,2607	0,0000 ***	-
PRICE	0,0952	0,0370	0,0101 **	0,0318
CBROWNCO	-3,4719	1,1442	0,0024 ***	-0,1116
FRE.FBRIGHTCO	-0,5713	0,2405	0,0175 **	-0,0050
FRE.FBROWNCO	-0,7133	0,3780	*0,0592* *	-0,0062
FRE.TDARKCO	3,7014	1,9604	*0,0590* *	0,0325
FRE.TNELLOREB	-3,3003	1,6080	0,0401 **	-0,0289
FRE.TWITHOUTB	13,2524	4,4611	0,0029 ***	0,1163
FRE.TBROWNCO	-2,8524	1,3094	0,0293 **	-0,0250
FRE.VDARKCO	-1,7553	0,6874	0,0106 **	-0,0154
FRE.VSMALLMAR	-2,4407	0,7195	0,0007***	-0,0214
FRE.VMODERATEMAR	-0,9295	0,41418	0,0248 **	-0,0081
FRE.VABUNDANTMAR	-1,6202	0,4790	0,0007 ***	-0,0142
FRE.VPRICE380	-1,1141	0,5596	0,0465 **	-0,0097
FRE.VWITHOUTB	-5,4550	1,5222	0,0004 ***	-0,0479
FREQCONS_C	5,3391	2,0705	0,0099 ***	0,0265
FREQPURCHASE__D	-7,3969	2,0462	0,0004 ***	-0,7977
MED_COMP	-1,4765	0,5006	0,0031 ***	-0,0129
n				229
AIC				92,213
Mc Fadden (Pseudo-R2)				0,74
Cox-Snell (Pseudo-R2)				0,51
NagelKerke (Pseudo-R2)				0,83

Notes. (1) ***, **, * indicate a significance of 1%, 5% and 10%, respectively;
Marginal Effect (MgE).
n corresponds to the size of the data sample

3.4.2.1. First fixation

Considering the first fixation, two visual cues related to colour were significant, FRE.FBRIGHTCO and FRE.FBROWNCO. In the study we contemplated visual cues for fresh beef including, colour, breed, marbling, and price; however, the information about colour was the only one found as significant for first fixation. This is in accordance with the findings of Wadhera and Capaldi-Phillips (2014) and Imram (1999). Consumers who first fixated on colour information reduced the purchase probability by 0.50% by looking at visual cue information FRE.FBRIGHTCO and by 0.62% after looking at visual cue information FRE.FBROWNCO. These results indicate that, for the sample of consumers studied, the colour of fresh beef is the visual cue that attracts the visual attention of consumers during the first fixation. However, it reduces the purchase probability and does not appear to be an interesting information to be communicated. This result is contrary to the online survey on

beef consumers carried out by Malheiros et al., (2022), in which the authors found that bright red colour information increased the probability of choice by 37%. However, that study used discrete choice as the analysis methodology, but data collection was via an online form, not by measurement of visual attention. It can be suggested that there is need for complementary studies, comparing different methodologies, to better elucidate the effect of information on the visual cue of bright red colour on the probability of choice of beef.

Changes between the bright red colour (oxymyoglobin) and brown colour (metmyoglobin) of beef can be considered as an "extreme" change (Wu et al., 2020). Brazilian consumers typically find dark-coloured beefs (deoxymyoglobin) at the point-of-sale (Yang et al., 2022). We suggest that the first fixation, which is concentrated on the colour, is due to the difference from what is typically expected, which can cause distrust (Rebollar et al., 2015) and culminate in the reduction of the purchase probability.

Alternatively, a possible justification for why other quality cues were not significant when first fixating, may be the lack of understanding of the consumer about those parameters or not being able to determine other attributes for the beef choice (Bialkova et al., 2020).

3.4.2.2. Total fixation

Considering the total time (seconds) that participants fixated on specific attributes, visual cues including colour and breed were significant: FRE.TDARKCO, FRE.TBROWNCO, FRE.TNELLOREB and FRE.TWITHOUTB. The information on visual cues FRE.TDARKCO and FRE.TWITHOUTB increased the probability of choice by ~3% and ~12%, respectively. However, FRE.TNELLOREB and FRE.TBROWNCO reduced the probability of choice by ~3% and ~2.5%, respectively. The correlation found between total fixation time and probability of choice is similar to Fenko et al. (2018), who state that the increase in visual attention increases the probability of choice. We note that the visual cues that had a reduction in the probability of purchase may be indicative of difficulty in interpretation by consumers.

Regarding FRE.TDARKCO, the increased purchase probability as consequence of visual attention increase may be motivated by the consumer's familiarity with that information (Fenko et al., 2018, Graham et al., 2012), as in Brazil, beef is mostly presented at the point of sale with a brown colour (Lobo Jr et al., 2012). This result agrees with Malheiros et al. (2022), who found a 20% increase in the probability of choice for beef with that information. Although we studied the fixation on colour, before the presentation of the products in the equipment, consumers were asked to visualise a colour pattern, guided by the authors.

For FRE.TBROWNCO the reduction in the probability of choice can be due to doubts in the interpretation of this information, because it is known that the colour of beef can change according to

the type of packaging - typically, vacuum packed beefs are brown in colour (Nassu et al., 2012, Venturini et al. 2010). In addition, microbiological, physicochemical or temperature changes may also give beef a brown colour (Velasco et al., 2016; Lavieri and Williams, 2014). Thus, we attribute the consumer's doubt to these known colour variations and their concerns with quality.

The increase in the probability of choice when viewing the information FRE.TWITHOUTB may indicate that the consumers participating in this study understand that less information about beef is more attractive and facilitates their choice, thus visual cues of the beef itself can be a sufficient source of information (Bialkova et al., 2016; Imram, 1999). The reduction in the probability of choice caused by the information FRE.TNELLOREB may indicate that consumers have doubts about how to use this information and, due to lack of knowledge and understanding of differences between breeds, they preferred to purchase beef without a defined breed. The possible justifications of this may be previous negative experiences associated with beefs that were of Nellore breed, lack of knowledge about the contribution of the breed to the quality of beef, or even the habit to consume beefs that do not have identification of the breed (Ferraz & Felício, 2010; Aboah and Lees, 2020; Ardeshiri and Rose, 2018).

Except for the brown colour, which was significant in participants' first fixation, we noted that marbling was not significant during the first fixation, and this was of lower interest to consumers when first assessing beef.

3.4.2.3. Total number of fixations

Considering the number of times that each participant fixated on an AOI (visit), colour, marbling, price and breed were significant, namely: FRE.VDARKCO, FRE.VSMALLMAR, FRE.VMODERATEMAR, FRE.VABUNDANTMAR, FRE.VPRICE380 and FRE.VWITHOUTB. The correlation between number of fixations (visits) and probability of choice is the inverse to that detailed by Fenko, et al., (2018), which reinforces our hypothesis that information about these visual cues may be difficult to interpret by study participants.

When analysing the information on FRE.VDARKCO, we observed that the probability of the consumer choosing a beef with this information was reduced by 1.54% each time the individual re-visited fixating on the dark red colour. The return of the consumer to the same visual cue indicates importance, doubt or difficulty in understanding the attribute (Muñoz-Leiva et al., 2021; Leon et al., 2020). Additionally, the understanding of information can be facilitated or hindered according to the level of consumer involvement with beef (Font-I-Furnols and Guerrero, 2014; Ardeshiri and Rose, 2018). We did not measure the level of involvement of participants in this experiment, but future studies may contribute to the confirmation or rejection of this hypothesis.

The information on the visual cues FRE.VSMALLMAR, FRE.VMODERATEMAR and FRE.VABUNDANTMAR reduced consumer choice by 2%, 0.8% and 1.4% at each return fixation, respectively. All levels of marbling were important for consumers participating in the study; however, they reduced the probability of purchase. These results differ partially from the findings by Banović et al. (2016), who identified a higher preference for beefs with lower fat content and found that beefthat vary in fat content can produce different patterns in visual attention and product choice, however, the present study found the same pattern for all levels of marbling. The differences found may be due to different cultural habits since the Banović study was conducted with Portuguese consumers. A possible explanation for our results may be the concern of participants with health and daily fat consumption (Banović et al., 2009 , Grunert et al., 2004) as well as the level of knowledge about the contribution of marbling to flavour, succulence and tenderness of beef (Banović et al., 2012). Consumers who make health-based food choices are more likely to seek information that helps them assess the healthiness of products, but may encounter difficulties related to knowledge and quality cues of the product (Hess et al., 2012, Grunert et al., 2010).

Regarding FRE.VPRICE380, the high number of visits indicates the importance of this visual cue for consumers, which may represent a reduction in the probability of choice due to mistrust and difficulty in identifying trade-offs. In Brazil, one kg of beef typically costs >$3.80. When consumers find cheaper prices, they tend to distrust the establishment or the characteristics of the product; this is reflected in the reduction of the probability of purchase by 0.97% each time the individual fixates on the price. These results agree with that found by Malheiros et al. (2022), who also identified a reduction in the probability of choice for beefs with lower prices. Additionally, consumers make decisions based on a variety of quality and visual cues. For beef, there is a range of products available, and consumers need to evaluate both regulated and strategic visual cues before deciding which confers greater complexity (Ares et al., 2013).

Regarding breed, some consumers may understand that the presence of information about the breed can help them distinguish between beef quality, even without understanding the exact differences between them. Regarding the information FRE.VWITHOUTB, the high number of visits to this attribute may indicate distrust or lack of understanding of differences between breeds, as there was a reduction in the probability of choice by 4.79% for each fixation.

The dark colour of beef, without breed information, showed different behaviours between the metrics, when evaluated for total fixation they increased the probability of choice; however, when evaluated considering the number of fixations (visits) the probability of choice was reduced.

For both total fixation time and the number of visits, greater visual attention reduced the probability of choice for all visual cue information. One hypothesis may be that beef consumers are more sensitive to information about visual cues which lead them to rejecting beef, than they are to information that is of interest. It is likely that the lack of familiarity with the information presented to

consumers may justify difficulty in interpreting the information, resulting in preference for not buying beef with unknown information.

3.4.3. Visual attention – cooked beef

Regarding the predicted values obtained with the estimated model for cooked beef, when comparing them with the observed values of the sample, an accuracy index of ~96.7% concordance was established, which, according to Pino (2007), indicates a good fit of the data.

Table 3. Estimates of *Logit* model coefficients for cooked beef and respective values of marginal effects.

Variables	Coefficients	Standart desviation	*p*-valor	MgE#
Intercepto	1,14007	1,62154	0,4820ND	-
PRICE	0,16837	0,06606	0,0108 **	0,0050
TOUGHMC	-2,21684	0,86441	0,0103 **	-0,1660
COO.FTOUGH	-0,88719	0,20065	0,0000***	-0,0266
COO.FWEAKFLAVOUR	-0,36660	0,15630	0,0190 **	-0,0110
COO.VPRICE580	-0,99133	0,32722	0,0024***	-0,0297
COO.VPRICE900	-2,28778	0,65485	0,0005***	-0,0686
COO.VINTENSEFLAVOUR	-0,61987	0,29383	0,03489**	-0,0186
FREQCONSU_B	2,09243	0,84142	0,0128 **	0,0867
FREQPURCHASE_D	-1,74068	0,87018	0,0454 **	-0,0944
N				226
AIC				85,109
Mc Fadden (Pseudo-R2)				0,68
Cox-Snell (Pseudo-R2)				0,46
NagelKerke (Pseudo-R2)				0,77

Notes. (1) ***, **, * indicate a significance of 1%, 5% and 10%, respectively; (2) ND not significant (significance above 10%)
Marginal Effect (MgE).
n corresponds to the size of the data sample

3.4.3.1. First fixation

Considering the first fixation, tenderness, and flavour were significant in our model: COO.FTOUGH e COO.FWEAKFLAVOUR. In the present study, consumers contemplated visual cues including flavour, aroma, tenderness, and price. The most significant for first fixation was ‘weak flavour’ and ‘tough beef’. First fixation on these attributes suggests that consumers looking for cooked beef primarily considered information on taste and tenderness. Those with weak flavour and tough beef reduced the purchase probability by 2.6% and 1%, respectively, as this is negative information.

The findings agree with Malheiros et al. (2022), who evaluated the same visual cues through online research to identify which cooked beef information increases the probability of choice. They found that there is a significant reduction in the probability of choice when the product had weak flavour and tough beef. The aim of the present study was to include negative information in the product description – this is not likely to occur in a real purchase situation, but we found it important to highlight that visual cues that refer to undesirable characteristics should be the target of future studies.

For the metric referring to time of the first fixation, the visual cues which were most significant were tough meat and weak flavour, again demonstrating that contrary to the behaviours identified for fresh beef, consumers of cooked beef are more interested in avoiding meatbeefs with negative information about attributes. These results are in accordance with Malheiros et al. (2022). A possible explanation for this may be the repeated experiences of beef consumption with these negative characteristics.

3.4.3.2. Total number of fixations

Considering the number of times that individuals visited an AOI, the information regarding price and taste was significant: COO.VPRICE580, COO.VPRICE900 e COO.VINTENSEFLAVOUR. Only two levels of price and one level of flavour had a high frequency of visits, demonstrating that they can be considered to be key information which correlate to doubt or difficulty of understanding by consumers.

Regarding COO.VPRICE580 and COO.VPRICE900, each time the consumer revisited the AOI, there was a reduction in the probability of choice by 2.97% and 6.86%, respectively. Due to the price of cooked beef in Brazil and possible previous experiences, consumers may be resistant to choosing more expensive beefs, another important point to highlight is that consumers may have had difficulty in differentiating the visual cues of beef of each value, not being able to identify the trade-offs of the beef costing US$ 9.00 compared to that costing US$ 5.80. Malheiros et al. (2022) also found a decrease in the probability of purchase for beef with a price of US$ 9.00/kg.

Finally, when considering COO.VINTENSEFLAVOUR, the high number of returns to this information may indicate consumer preference. We observed that the probability of the consumer choosing a beef reduces by 1.86% each time they re-visited the AOI related to intense flavour.

Unlike fresh beef, metrics referring to the number of return fixations of cooked beef were composed of information about attributes that generate difficulty of understanding or differentiation (i.e., breed). For cooked beef the total time of fixation on AOIs was not significant, so they were not included in the model. A possible justification for this may be greater understanding and familiarity of consumers with visual qualities of cooked beef compared to fresh beef (Fenko et al., 2018; Graham et al., 2012). Interestingly, cooked beef is usually presented with little information available, so the

increase in information in the study may have caused confusion and difficulty, because they are desirable quality cues, but not normally reported.

This study was conducted only from the perspective of applying an online questionnaire, therefore complementary studies are recommended to assist in understanding how visual cues of beef can interfere with the probability of purchase. For future studies we suggest using photographs of beef with desirable study characteristics, for example, colour variations and marbling. Additionally, when considering the proposed analytical model, we also recommended that the current study is repeated with consumers from other Brazilian regions, nationalities, and other categories of food. One limitation of the present study is that the methodology is usually applied in controlled situations and may not be as realistic compared to the conditions of purchase.

3.5. Conclusion

Visual attention is the process by which consumers use visual attributes to determine if they are interested in an object. In terms of beef, these may be attributes that consumers know, and these can either increase or reduce the probability of choice. Except for dark colour and without breed information, all of visual attributes studied reduced the probability of consumers making a choice, which may be an indication that the participants of this study focused visual attention on the information they reject. Another possible inference may be the lack of familiarity of consumers with strategic visual cues since they are not used in a standardised way by private initiatives. This likely caused consumers of this study to prefer products with known information or products without additional information. The inclusion of additional information in the packaging of beef requires, above all, consumer education work, so that when viewing the information, consumers are prepared to use this in their decision-making. Information on marbling and different breeds should be highlighted only if it is clear to the consumer what is the benefit of these attributes for the final product. It may therefore be beneficial to include this information as explanatory texts on the packaging. Legislation on strategic visual cues can be implemented, so that mandatory additional information should be place on the packaging, or standardisation of specific information should be enforced to highlight relevant health attributes.

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4. VALORES PESSOAIS ASSOCIADOS A *QUALITY CUES* DA *FRESH AND COOKED BEEF*: UM ESTUDO *LADDERING* APLICADO A CONSUMIDORES DO SUDESTE BRASILEIRO

Artigo de acordo com as diretrizes do *Journal of Food Quality and Preference* – versão em tradução para submissão

Resumo

Estudos apontam que os valores pessoais direcionam escolhas alimentares, de modo que os consumidores desenvolvem critérios e padrões de produto que serão exigidos durante a tomada de decisão. A partir disso, existe o desafio de atender às exigências dos consumidores bem como educá-los sobre as *quality cues* intrínsecas e extrínsecas da carne bovina, com o objetivo de combater o *marketing* negativo sobre essa categoria de alimento e evitar reduções no consumo. Cada indivíduo possui valores pessoais, que podem variar conforme nacionalidade, tipo de produto, cultura, entre outros. Devido à subjetividade dos valores pessoais, o presente estudo se concentrou em identificar os principais associados as *quality cues* de carne bovina crua e cozida, através da técnica de *laddering*, explorando a teoria das cadeias meio-fim e dos valores pessoais descritos Rokeach. Foi realizada uma entrevista de profundidade com quinze consumidores, que declararam comprar e consumir carne bovina. Os participantes foram estimulados visualmente sobre as *quality cues* estudadas, para fins de padronização do entendimento. Para obtenção dos mapas hierárquicos de valor foi realizada redução das entrevistas sem perda de conteúdo, até alcançar os valores pessoais de cada indivíduo e após essa etapa foi utilizado o *software* MECanalyst. A interpretação das *ladders* foi realizada partindo do ponto de vista não só dos valores pessoais, mas também a partir do contraponto entre percepção do consumidor e características físico-químicas da carne bovina. Encontramos que carnes cruas e cozidas compartilham o mesmo valor principal e possuem motivações de consumo tanto utilitárias quanto hedônicas. Estudos futuros são recomendados para auxiliar na compreensão dos valores pessoais mais relevantes para população brasileira, especialmente concentrados em diferentes regiões do país.

Palavras-chave: Valores pessoais, *Quality cues, Meat quality, Laddering*

4.1. Introdução

Os consumidores tomam decisões de compra de alimentos com base na avaliação das *quality cues* intrínsecas e extrínsecas disponíveis sobre os produtos, as quais oferecem informações e dicas de qualidade que auxiliam na criação de expectativas e no processo de escolha (Grunert et al., 1995), permitindo a formação de impressões subjetivas sobre a qualidade do alimento. Essa percepção da qualidade é embasada em processos psicológicos que são influenciados tanto pelo nível de conhecimento prévio quanto pelas competências cognitivas individuais (Bredahl, 2004). Esses processos traduzem a obtenção de consequências e valores desejados, que podem ser correlacionadas com os atributos de experiência, credibilidade, segurança, saudabilidade, sustentabilidade, dentre outros que poderão ou não motivar a escolha (Aboah & Lees, 2020; Grunert et al., 1995). Assim, os valores buscados pelos consumidores impactam na qualidade exigida, na percepção e avaliação das *quality cues* do alimento, de modo que a obtenção dos valores pessoais desejados compensa os custos

envolvidos (Grunert et al., 2004). De forma complementar, esses valores desejáveis não são padronizados e a percepção da qualidade pode ainda sofrer interferência da nacionalidade do consumidor, cultura ou nível de envolvimento (Font-I-Furnols & Guerrero, 2014).

Concentrando o foco na carne bovina, as *quality cues* intrínsecas são relacionadas às especificações técnicas da carne e características físicas que podem ser mensuradas, como cor, corte, teor de gordura, raça, sabor, maciez (Aboah and Lees, 2020; Borgogno et al., 2015; Banović et al., 2012). Por outro lado, as *quality cues* extrínseca representam todas as outras características do produto, como marca, preço, embalagem, entre outros (Morquecho-Campo et al, 2020; Meyerding et al., 2018; Brunsø et al., 2002). Em estudo realizado por Malheiros et al. (2022) com consumidores brasileiros, os autores encontraram que para a *fresh beef* a coloração da carne foi a *quality cue* que mais aumentou a probabilidade de compra, inclusive com maior disposição dos consumidores em pagar para obter essa característica. O marmoreio não foi significante para interferir na probabilidade de compra, no entanto, apresentou maior disposição dos consumidores em pagar para obtê-lo. Considerando a *cooked beef*, o sabor intenso contribuiu para aumento na probabilidade de compra enquanto o sabor fraco reduziu a probabilidade de compra. A maciez apresentou comportamento semelhante, de modo que a carne macia aumentou a probabilidade de compra e a dura reduziu.

Tomando como base os resultados obtidos na pesquisa mencionada, a relevância dessas *quality cues* na probabilidade escolha da carne bovina, que os valores pessoais direcionam o comportamento de escolhas alimentares dos consumidores e que os mesmos podem variar de acordo com a nacionalidade, objetivamos identificar quais os principais valores associados as *quality cues* da carne bovina crua e cozida em um grupo de consumidores da região sudeste brasileira. Adicionalmente, espera-se obter como resultado as semelhanças e divergências entre consumidores de outras nacionalidades e sugerir meios que ajudem a aprimorar a comunicação sobre as *quality cues* da carne.

Conforme descrito em estudos anteriores, os valores pessoais são padrões que orientam escolhas e comportamentos, formados a partir de experimentações pessoais, sociais e culturais, representando como a estrutura cognitiva conecta os atributos de um produto às consequências e valores desejáveis (Roininen et al., 2006; Gutman, 1982). Nesse contexto, a tomada de decisão dos consumidores visa o alcance dos valores priorizados e refletem o que as pessoas pensam ser importante para elas, podendo variar de acordo com o tipo de alimento e significado que assumem (Tey et al., 2018; Phillips & Reynolds, 2009; Rokeach, 1979; Rokeach, 1973). A exploração de valores pessoais tem sido utilizada para auxiliar no entendimento das motivações dos consumidores para diversas escolhas de produtos em diferentes países, incluindo alimentos (Russell et al., 2004), a saber: yogurts (Ares et al., 2008), óleo vegetal (Santosa & Guinard, 2011; Nielsen et al., 1998), biscoitos (Puerta et al., 2022), frutas (Sun & Collins, 2007), pork (Lind, 2007), café (Silva et al., 2022; Ferran & Grunert, 2007), alimentos orgânicos (Baker et al., 2004), nos quais foram encontrados como valores saúde, nutrição, características sensoriais e prazer.

Tomando como base os valores pessoais de diferentes categorias de alimentos identificados para os consumidores brasileiros tem-se alegria e felicidade como valores associados ao vinho (Castro et al., 2019), nacionalismo e solidariedade com produtores locais para doce de leite (Durço et al., 2021), saúde e segurança como valores para produtos locais (Marques et al., 2022), segurança como valor principal para carnes de animais alimentados a pasto (Chini et al., 2020), tradição, segurança e realização aparecem como valores para café (Silva et al., 2022). Concentrando o foco nos valores pessoais de carne bovina, têm-se que para consumidores da Espanha a identificação cultural e autoestima elevada são os principais componentes de escolha (Barrena & Sánchez, 2009). Para consumidores da Bélgica têm-se que o valor prioritário é a integridade/segurança (Vannoppen et al., 2008), por outro lado, para o grupo de consumidores da Austrália o valor relacionado a "aproveitar" a vida foi o mais relevante (Flight et al., 2003). São evidenciadas diferenças entre os valores pessoais relevantes entre diferentes nacionalidades e também entre diferentes tipos de alimentos. Informações sobre os valores pessoais dos consumidores são úteis para o marketing de alimentos, pois podem direcionar políticas para construção de estratégias que permitam atender às demandas dos consumidores, bem como seguimentos desejáveis de mercado específico (Lee et al., 2014).

A indústria da carne bovina, assim como outras indústrias alimentícias, possui o desafio de atender às exigências de qualidade dos consumidores. Nos últimos anos as pressões ambientais, de saudabilidade, de segurança e de qualidade sensorial têm se apresentado como novo desafio para o segmento, com riscos de redução no consumo (Neuhofer & Lusk, 2019; Gómez-Luciano et al., 2019; Bianchi et al., 2018). Nesse contexto, entregar ao consumidor uma carne com qualidade consistente e que corresponda às expectativas é a melhor estratégia de resposta às publicidades negativas relacionadas a produção e consumo de carne (Allen, 2021). Como tentativa de melhorar a comunicação com o consumidor e de criar diferenciação dos produtos, o setor se concentrou em criação de marcas para diferenciação no ponto de venda (Ling et al., 202), e sistemas preditivos de qualidade de carne vem sendo desenvolvidos, como por exemplo o Meat Standards Australia (MSA), que comunica ao consumidor a qualidade da carne através de selos na embalagem (McGilchrist et al., 2019, Berri et al., 2019), no entanto, não estão disponíveis em todos os países. Considerando que diferentes motivações podem nortear o consumo de carne, é necessária a realização de uma comunicação assertiva com os consumidores de carne bovina, para tanto são demandadas diferentes abordagens que auxiliem na escolha (Ali et al., 2018), as quais podem ser delineadas a partir do conhecimento sobre quais critérios o público-alvo utiliza para escolher entre comprar ou não comprar carne bovina.

4.2. Material e Métodos

O estudo foi realizado em dezembro de 2020 no estado de São Paulo. Objetivou-se utilizar amostra de consumidores com maior nível de escolaridade, para tanto foram convidados quinze participantes, selecionados de maneira aleatória a partir da rede de contatos dos pesquisadores e indicações de demais participantes. Todos os convidados declararam consumir e comprar carne bovina pelo menos uma vez por semana, além disso, foram visualmente estimulados antes da entrevista (ver imagem 1 do material suplementar), com o objetivo de calibrar o conhecimento dos consumidores sobre as *quality cues* estudadas da carne bovina.

A coleta de dados foi realizada com horário agendado para evitar aglomerações, em local aberto e respeitando os protocolos sanitários da OMS e autoridades locais de prevenção à Covid-19. Além disso, a coleta de dados atendeu todas as exigências da Resolução de número 510/16 da Comissão Nacional de Ética em Pesquisa (CONEP, 2016) quanto à proteção dos participantes da pesquisa e foi aprovada pelo comitê de ética em pesquisa com seres humanos (CEP) da ESALQ/USP, instituição sede dos pesquisadores.

De acordo com os autores Reynolds e Gutman (1988), o *Laddering* consiste em uma metodologia de entrevista em profundidade, realizada individualmente, com objetivo de identificar a base de decisão de compra dos consumidores, bem como a forma pela qual eles relacionam determinado atributo de um produto com valores e significados pessoais. Em outras palavras, auxilia na identificação de quais as consequências (benefícios) e valores significativos para o consumidor (Roininen et al., 2006).

Consiste em uma técnica de entrevista em profundidade baseada na teoria da cadeia meios-fim e é comumente usada em pesquisas sobre comportamento do consumidor. As entrevistas no formato *laddering* questionam os consumidores sobre as características capazes de descrever ou distinguir marcas ou produtos. O objetivo é estimular os participantes a subirem uma escada de abstração até o momento em que atingem o patamar dos valores, essa extração de informações é feita através de perguntas repetitivas (Phillips e Reynolds, 2009; Veludo-de-oliveira, 2006). Uma ladder é definida como a sequência de respostas de um participante do atributo para um nível mais alto de abstração, até alcançar os valores pessoais. As escadas são decompostas em componentes diretos e reconstruídas em dados agregados para formar cadeias, representadas graficamente por mapas hierárquicos de valor (Russell et al., 2004), assim, as entrevistas possibilitam a construção de uma rede hierárquica de significados, que são iniciados pelos atributos, passam pelas consequências e finalizam nos valores pessoais (Phillips e Reynolds, 2009). No presente estudo concentramos as entrevistas nas *quality cues* cor e marmoreio para a *fresh beef* e maciez e sabor para *cooked beef,* de modo que cada participante foi entrevistado sobre um atributo da *fresh* and *cooked beef*, obedecendo a seguinte combinação: cor e maciez (n=7) e marmoreio e sabor (n=8).

Foi realizada uma entrevista semiestruturada, a qual enfatizou aos participantes que "não havia respostas certas ou erradas" e que estávamos interessados na percepção individual sobre as *quality cues* escolhidas. A entrevista durou entre 30 minutos e 1 hora e foi composta pelas seguintes questões: 1-"Por favor, diga as palavras que descrevam o atributo (cor, marmoreio, sabor ou maciez) da carne bovina e depois ordene de acordo com a importância" e 2-"Por que é importante pra você?", conforme o participante respondia às questões sobre a palavra destacada como mais importante, questionava-se porque a resposta era importante e outras perguntas eram feitas na sequência com objetivo de extrair os valores terminais e instrumentais de Rokeach (1973) e esgotar as respostas. As entrevistas foram gravadas, com consentimento dos participantes, e foi transcrita na íntegra para tratamento análise de conteúdo, assim como Bardin (2011).

As entrevistas foram analisadas e reduzidas, sem perda de conteúdo, a atributos concreto (Ac) e abstrato (Aa) e consequências funcional (Cf) e psicológica (Cp), de modo que foram agrupados os de mesmo significado e categorizados até alcançar os valores instrumentais (Vi) e terminal (Vt) (Gengler & Reynolds, 1995; Reynolds e Gutman, 1988). A partir desse agrupamento foram criadas ladders no *software* MECanalyst (plus ver 1.0.15) e gerados mapas hierárquicos de valor (Roininen et al., 2006).

O mapa de valor foi obtido através do *software* MECanalyst. O atributo considerado para a criação cadeia de valor no MECanalyst foram as palavras mais importantes associadas a *quality cue* da carne bovina questionada. Como consequências, considerou-se as questões sobre o porquê da importância do atributo e por quê essa resposta é importante. Os valores foram atribuídos para os atributos e consequências seguindo as dezoito dimensões de valores propostas por Rockeach (1973), apresentadas na tabela 1. De acordo com o autor, existem dois níveis para mensurar os valores pessoais: terminais, que se relaciona com o estado final de existência desejado; e instrumentais, relacionados aos modos de conduta desejáveis.

Tabela 1: Valores Pessoais segundo Rockeach (1973)

Valores terminais	Uma vida próspera, uma vida excitante, um mundo de paz, igualdade, liberdade, felicidade, segurança nacional, prazer, salvação, reconhecimento social, amizade verdadeira, sabedoria, um mundo belo, segurança, amor maduro, respeito próprio, senso de realização, harmonia interna
Valores instrumentais	Ambicioso, mente aberta, capaz, alegre, limpo, corajoso, generoso, solícito, honesto, imaginativo, independente, intelectual, lógico, amoroso, obediente, polido, responsável, autocontrole

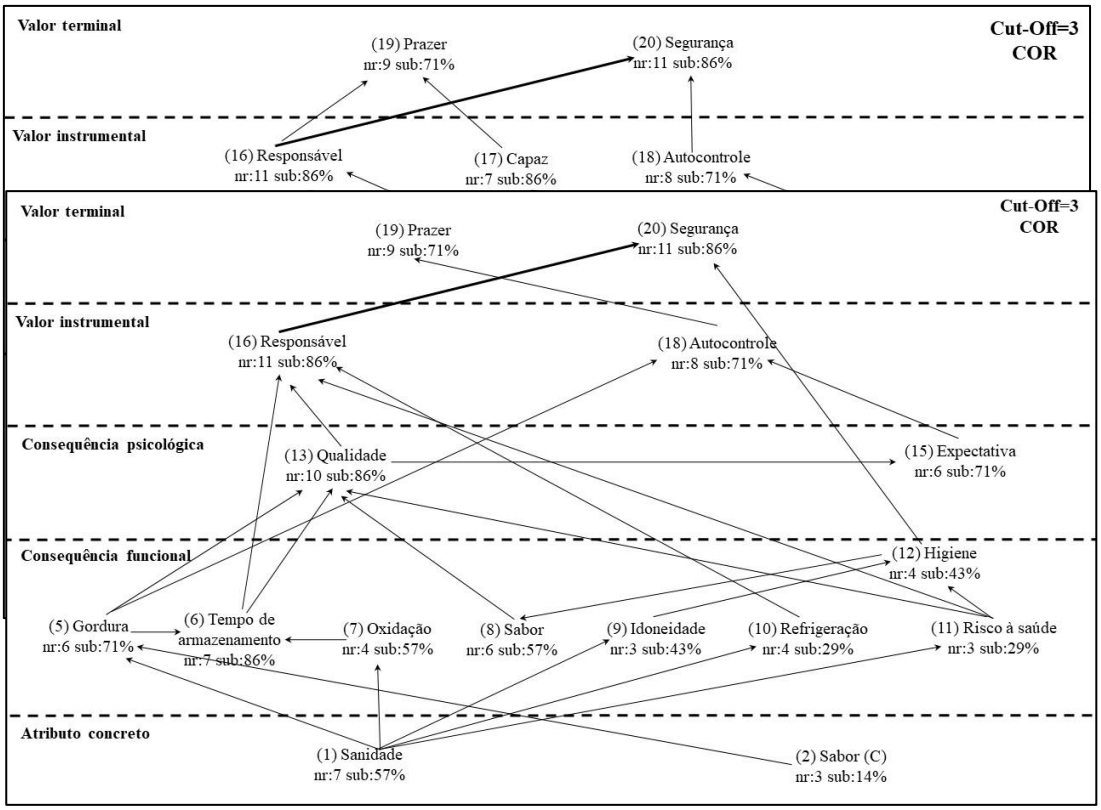
As setas no mapa hierárquico de valor, que serão apresentados nos resultados, representam o caminho de raciocínio do consumidor, que liga os atributos, consequências e valores. A quantidade de

links entre os conceitos reflete a complexidade do mapa e a espessura da linha das setas ilustra o número de participantes que fizeram a relação. O *software* forma as cadeias e analisa a quantidade de relações semelhantes feitas pelos participantes (Roininen et al., 2006), possibilitando escolher um nível de corte (cut off) para gerar relações do mapa hierárquico. Foram escolhidos os cut off nível de corte: três para cor, dois para sabor e maciez e quatro para marmoreio. As ladders geradas foram analisadas tomando como base os valores pessoais identificados e também aspectos físico-químicos da carne bovina, visando obter o contraste entre características da carne e percepção do consumidor.

4.3. Resultados e Discussão

4.3.1. *Laddering* cor

Para a *quality cue* cor foi gerado o mapa de valor das figuras 2 A e B, totalizando 15 ladders que finalizaram em dois principais valores terminais: prazer e segurança. Para a construção deste mapa foi considerado o nível de corte 3, de modo que apenas ligações diretas e/ou indiretas entre atributos, consequências e valores que apareceram pelo menos três vezes foram consideradas. Os atributos, consequências e valores para a *quality cue* cor estão descritos em detalhes na tabela 2 (material suplementar) e a descrição detalhada ladders geradas estão na tabela 3 (material suplementar).



Figuras 2 A e B: Mapas hierárquicos de valor para *quality cue* cor

Destaca-se a sanidade (57%) como único atributo que iniciou as ladders referentes ao valor terminal segurança. Para esse atributo os participantes construíram relações principalmente com tempo de armazenamento (86%), refrigeração (29%) e higiene do estabelecimento (43%), demonstrando preocupação com o risco à saúde (29%) que pode ser causado em casos de "falta de sanidade" do alimento. Como consequência psicológica teve relação com a qualidade do alimento (86%), responsável (86%) como valor instrumental e prazer (71%) como valor terminal. É possível notar que os consumidores relacionam a coloração da carne bovina à sanidade do produto, portanto se sentem responsáveis no momento da escolha de selecionar um alimento idôneo, com menor risco à saúde e de causar problemas como intoxicação alimentar, ou seja, alimento seguro para o consumo. Esses achados estão de acordo com Chini et al. (2020).

O atributo armazenamento (43%) apresentou principais relações com as consequências funcionais atributos tempo de armazenamento (86%), oxidação (57%), sabor (57%) e refrigeração (29%), e como consequências psicológicas destacam-se se qualidade (86%) e experiência de consumo (43%), responsável também aparece como responsável (86%) como valor instrumental, prazer (71%) e segurança (86%) como valores terminais. Levando em consideração o atributo armazenamento nota-se que a preocupação dos participantes se concentrou em riscos de alteração no sabor da carne, potencialmente causados por falhas na refrigeração e pelo maior tempo de armazenamento. A cor se relaciona com esse contexto porque os consumidores entendem que uma carne que está armazenada a mais tempo no ponto de venda ou que teve problemas com a refrigeração apresentará descoloração em comparação à uma carne nova, essa percepção dos consumidores está de acordo com o processo bioquímico que favorece a reação de oxidação da mioglobina (pigmento responsável pela coloração da carne) que a transforma em deoximioglobina ou metamioglobina, responsáveis por tonalidades vermelho-escuro e marrom, respectivamente (Zhang et al., 2023; Henriott et al., 2020). Além disso, há o risco microbiológico percebido e associado à coloração mais escura (dark cutting). Os riscos reconhecidos e eventualmente experimentados anteriormente fazem com que os consumidores se preocupem na segurança do alimento que estão consumindo, além de desejarem uma experiência de consumo prazerosa.

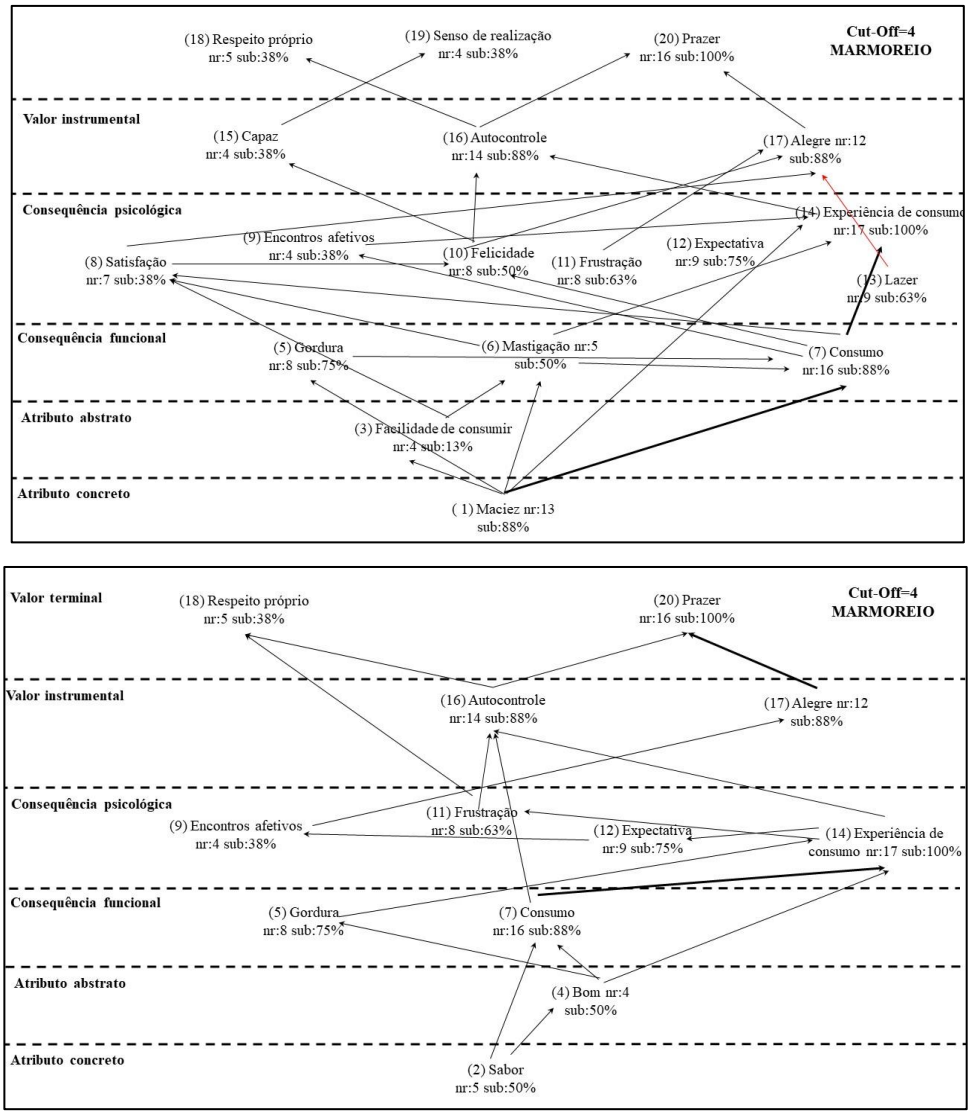
O atributo sabor (14%) teve como consequência fundamental a gordura (71%) e consequências psicológicas qualidade (86%) e expectativa (71%), como valores destacam-se o autocontrole (71%) e prazer (71%). De acordo com os participantes, o sabor da carne é dependente de uma aparência boa (carne vermelha) e do teor de gordura, esse achado está de acordo com Grunert (1997), que encontrou relação forte entre a aparência visual da carne bovina e a qualidade esperada pelos consumidores europeus, os quais inferiram a qualidade principalmente a partir da cor e proporção de gordura. Ainda de acordo com a percepção dos participantes, a presença de gordura ajuda a melhorar sabor, textura e aparência da carne, gerando aumento nas expectativas e garantindo maior prazer ao consumir carnes com essas características. Tomando como base a relação criada pelos participantes entre cor e sabor, é importante destacar que o entendimento do consumidor sobre

determinada *quality cue* da carne bovina não necessariamente está em consonância com os aspectos físico-químicos descritos para carne bovina. Considerando o sabor, é conhecido que ele é dependente da composição da carne, como perfil de aminoácidos e carboidratos, não da coloração (Barragán-Hernández et al., 2022; Laird et al., 2015).

O atributo vermelho-vivo (57%) teve como principais consequências fundamentais tempo de armazenamento (86%), gordura (71%) e idoneidade (43%), as principais consequências psicológicas foram a qualidade (86%) e experiência de consumo (43%), com valores instrumentais responsável (86%), capaz (86%) e autocontrole (71%) e valores terminais segurança (86%) e prazer (71%). A utilização da cor como parâmetro de avaliação da qualidade da carne também foi descrita por Suman et al. (2014), além disso, Holman et al. (2016) encontraram que há diferença na aceitabilidade de cor em comparação a consumidores de outras nacionalidades. Com relação a estabilidade da coloração de carne exposta no ponto de venda, há oportunidade de desenvolvimento ou exploração de tecnologias de embalagens que mitiguem esses problemas, além de tecnologias de embalagens inteligentes que informem aos consumidores sobre a temperatura de refrigeração. Considerando preocupações associadas à refrigeração, há oportunidades tanto para o setor privado quanto público para otimizações na cadeia do frio no Brasil, especialmente no varejo que é a última etapa de armazenamento antes de chegar ao consumidor.

4.3.2. *Laddering* marmoreio

Para a *quality cue* marmoreio foi gerado o mapa de valor das figuras 3 A e B, totalizando 15 ladders que finalizaram em três principais valores terminais: Respeito próprio, senso de realização e prazer. Para a construção deste mapa foi considerado o nível de corte 4, de modo que apenas ligações diretas e/ou indiretas entre atributos, consequências e valores que apareceram pelo menos quatro vezes foram consideradas. Os atributos, consequências e valores para a *quality cue* marmoreio estão descritos em detalhes na tabela 4 (material suplementar) e a descrição detalhada ladders geradas estão na tabela 5 (material suplementar).



Figuras 3 A e B: Mapas hierárquicos de valor para *quality cue* marmoreio

O atributo maciez (88%) iniciou 11 ladders, de modo que uma chegou no valor terminal "respeito-próprio", duas chegaram no "senso de realização" e oito finalizaram no valor terminal "prazer". Para esse atributo os participantes construíram relações com atributo abstrato "facilidade de consumir" (13%), como consequências fundamentais destacaram-se "consumo (88%), gordura (75%) e mastigação (50%), como consequências psicológicas destaca-se a experiência de consumo (100%), felicidade (50%) e satisfação (38%), demonstrando preocupação com o risco à saúde (29%) que pode ser causado em casos de "falta de sanidade" do alimento. Como consequência psicológica teve relação com a qualidade do alimento (86%), por fim, como valores instrumentais destacam-se alegre e autocontrole (88%), ambos com mesmo percentual. Avaliando o atributo maciez nota-se que a preocupação dos participantes se concentrou na facilidade de consumo e mastigação, pois muitos relataram problemas dentários e incômodos já experimentados de enroscar carne no dente. Uma carne

sem maciez pode representar, na visão dos consumidores, modo de preparo inadequado ou um alimento que irá gerar desperdícios devido à dificuldade de consumir. Por outro lado, a carne macia está diretamente atrelada à melhor experiência de consumo, melhor apreciação de sabor, ao modo de preparo adequado e ocasiões de festa e lazer. A mesma preocupação com a experiência sensorial foi relatada para consumidores Argentinos (Testa et al., 2021). Sobre essa associação dos consumidores de carne macia a ocasiões especiais uma possível justifica pode ser a diferença de preços associadas a carnes commodities comercializadas no país, normalmente com preços mais acessíveis para o dia-a-dia, em comparação a carnes mais "premium" comercializadas por marcas específicas. Além disso, considerando a composição da carne bovina o marmoreio não é determinante para garantir maciez, mas pode contribuir dependendo da raça do animal (Scheffler, 2021).

O atributo sabor (50%) iniciou 4 ladders, de modo que duas chegaram no valor terminal "respeito-próprio" e outras duas chegaram no valor terminal "prazer". Para esse atributo os participantes construíram relações com atributo abstrato "bom" (50%), como consequências fundamentais destacaram-se consumo (88%), e gordura (75%), como consequências psicológicas destaca-se a experiência de consumo (100%) e frustração (63%), chegando aos valores instrumentais alegre e autocontrole (88%), ambos com mesmo percentual. Avaliando o atributo sabor destaca-se que a preocupação dos participantes se concentrou na qualidade do sabor, de modo que o sabor bom desperta a vontade consumir novamente, possibilita avaliar se a compra foi bem feita, se o modo de preparo estava adequado para o tipo de corte, indica que o alimento tem boa qualidade e gera uma experiência de consumo agradável. O sabor ruim, em contrapartida, promove a restrição de consumo e compra, gerando frustração por uma compra errada e comprometendo a experiência de consumo, tornando-a desagradável. Em estudo realizado com consumidores brasileiros de carne bovina (Malheiros et al., 2022), encontram a carne com sabor considerado fraco reduziu a probabilidade de compra, ao passo que a carne com sabor intenso aumentou a probabilidade de compra e a disposição em pagar por carnes com essa característica.

Para a *quality cue* marmoreio os participantes associaram à maciez e sabor, pois entenderam que o a presença da gordura na carne irá contribuir para essas duas características. Essa observação pode ser corroborada pelos trechos das entrevistas abaixo:

> "[...] *Eu sei que marmoreio é uma coisa que deixa a carne mais macia, Não necessariamente uma carne gorda, mas é uma carne mais macia do que as outras. Eu acho que é mais uma questão visual, se eu vejo que tem marmoreio eu sei que possivelmente vai ser uma carne mais macia.* [...]" (Consumidor 1).

> "[...] *Pra mim é importante ter o conhecimento do papel da gordura na qualidade final ao consumir a carne porque eu acredito que muito por ignorância e talvez de não saber como funciona, eu pensava que quanto menos gordura tivesse na carne melhor ela era, porque eu*

estaria comendo cem por cento carne. Depois que eu aprendi que a gordura trás todos os benefícios de maciez, sabor. [...] Então quando eu vejo uma carne que ela tem um marmoreio eu tenho mais interesse porque ela é uma carne macia e eu vou gostar mais de mastigar. [...]" (Consumidor 4).

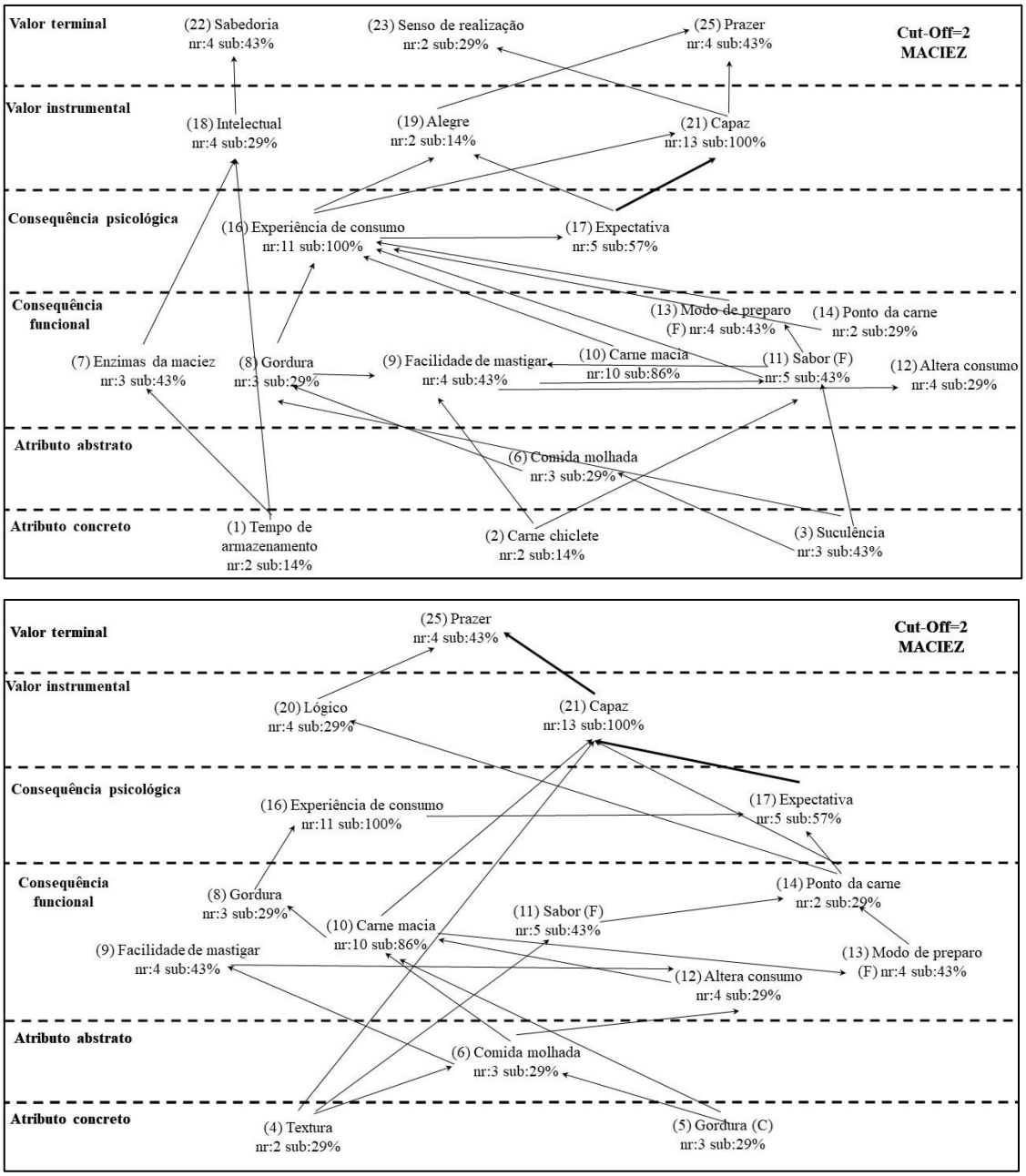
"[...] *Acredito que o marmoreio interfere no sabor. Por isso que eu olho primeiro de tudo o marmoreio, porque dá pra gente ver. Ai, por exemplo, se não dá pra identificar o marmoreio, eu procuro olhar a cor dela, eu acredito que se ela tá mais vermelha ela tem mais sabor*.[...]" (Consumidor 7).

"[...] *quando eu penso no marmoreio eu penso que quanto mais marmoreio a carne tem ela vai ter um sabor mais marcante, mais agradável. Além do sabor marcante, ela pode ser mais macia*. [...]" (Consumidor 8).

Destaca-se que na perspectiva do consumidor a *quality cue* marmoreio contribui para incrementos na maciez e no sabor da carne, atributos que ressaltam a associação e valorização da experiência de consumo, que pode será melhorada ou piorada, e o prazer da refeição. Relacionando com aspectos físico-químicos da carne, a gordura incrementa em sabor e maciez, no entanto depende do nível e de outros fatores, não sendo o único fator determinante (King et al., 2021), nesse sentido, o destaque do marmoreio deve ser estratégico e não induzir o consumidor ao engano, especialmente considerando a variabilidade dessa característica no gado brasileiro.

4.3.3. *Laddering* maciez

Para a *quality cue* maciez foi gerado o mapa de valor das figuras 4 A e B, totalizando 10 ladders que finalizaram em quatro principais valores terminais: Senso de realização, segurança, sabedoria e prazer. Para a construção deste mapa foi considerado o nível de corte 2, de modo que apenas ligações diretas e/ou indiretas entre atributos, consequências e valores que apareceram pelo menos duas vezes foram consideradas. Os atributos, consequências e valores para a *quality cue* maciez estão descritos em detalhes na tabela 6 (material suplementar) e a descrição detalhada ladders geradas estão na tabela 7 (material suplementar).



Figuras 4 A e B: Mapas hierárquicos de valor para *quality cue* maciez

Cinco atributos iniciaram as ladders para *quality cue* maciez, a saber: tempo de armazenamento, carne chiclete, suculência, textura e gordura. O atributo tempo de armazenamento (14%) teve relação com a consequência funcional “enzimas da maciez” (43%), finalizando nos valores “intelectual” (29%) e “sabedoria” (43%). Os consumidores entendem que o tempo de armazenamento impacta na ação das enzimas sobre as fibras cárneas e impacta diretamente no nível de maciez da carne. Essa percepção dos participantes está de acordo com os achados por (Barrena & Sánchez, (2009).

O atributo “carne chiclete” (14%) teve como principais consequências funcionais “facilidade de mastigar”, “sabor” e “modo de preparo”, ambos com percentual de 43%, como consequências psicológicas destacaram-se “experiência de consumo” (100%) e “expectativa” (57%), finalizando nos valores “capaz” (100%) e “prazer” (43%). Uma carne chiclete não corta bem, provoca dificuldades de mastigar comprometendo sabor, textura e consequentemente a experiência de consumo. Concentrando o foco no âmbito da expectativa, Malheiros et al. (2022) encontraram que os consumidores esperam consumir uma carne macia, pois não demonstraram aumento significativo na disposição em pagar por essa característica, no entanto, reduziram significativamente a disposição em pagar por carnes duras.

A “suculência” (43%) teve como atributo abstrato “comida molhada” (29%), como consequências fundamentais destacaram-se “gordura” (29%), “facilidade de mastigar” e “sabor”, ambos com 43%, e como principais valores “capaz” (100%) e “senso de realização” (29%). Na percepção dos consumidores a presença de gordura garante a suculência e gera facilidade de mastigar, contribuindo para melhor sabor e sensação de maciez, normalmente consumidas em ocasiões de confraternizações.

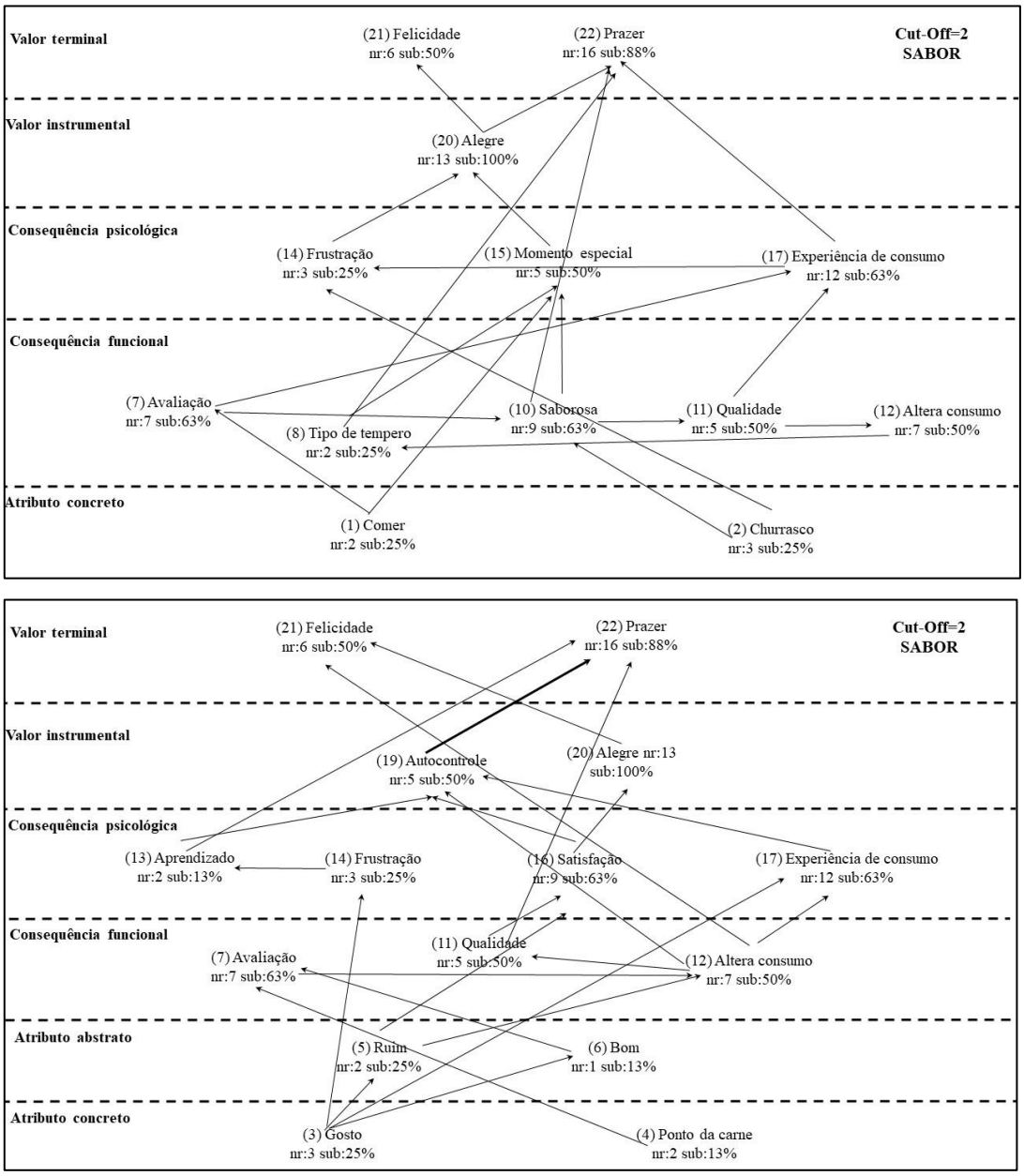
O atributo “textura” (29%) também teve como atributo abstrato “comida molhada” (29%), gerando consequências fundamentais e psicológicas distintas, que podem ser consultadas nas tabelas 6 e 7 (material suplementar) e na Figuras 4, mas que chegam aos mesmos valores “capaz” (100%) e “prazer” (43%). Esse atributo também contribui para facilidade de mastigar e estimula aumento no consumo por proporcionar experiências mais agradáveis. Além disso, ao visualizar a textura de uma carne alguns consumidores relataram ser capazes de criar expectativas de como ficará após cozimento.

O atributo “gordura” (29%) também teve relação com o atributo abstrato “comida molhada” (29%), principal consequência funcional “carne macia” (86%) e finalizando no mesmo valor terminal “prazer” (43%). De acordo com a percepção dos consumidores, a gordura se relaciona com a maciez por contribuir com a textura, além disso realça sabor. Esses efeitos são dependentes do modo de preparo, ponto da carne e tipo de corte.

Para a *quality cue* maciez os consumidores associam que a presença de gordura e contribui para suculência e textura, contribuindo adicionalmente para incremento no sabor que irá completar a experiência de consumo e o prazer de uma boa refeição. Essa relação é descrita por estudos anteriores Scheffler (2022). Pode-se notar que o valor instrumental “capaz” apareceu em praticamente todas as relações e demostra a importância que o consumidor atribui a escolher uma carne certa quando se trata de maciez. Adicionalmente, alguns consumidores relataram na entrevista (dados não apresentados) que a escolha errada muda o consumo e a participação no evento, podendo gerar frustração não só por ter a sensação da escolha errada, mas também por ter a sensação de não agradar às outras pessoas.

4.3.4. *Laddering* sabor

Para a *quality cue* sabor foi gerado o mapa de valor da figuras 5 A e B, totalizando 10 ladders que finalizaram em dois principais valores terminais: “felicidade” e “prazer”. Para a construção deste mapa foi considerado o nível de corte 2, de modo que apenas ligações diretas e/ou indiretas entre atributos, consequências e valores que apareceram pelo menos duas vezes foram consideradas. Os atributos, consequências e valores para a *quality cue* sabor estão descritos em detalhes na tabela 8 (material suplementar) e a descrição detalhada ladders geradas estão na tabela 9 (material suplementar).



Figuras 5 A e B: Mapas hierárquicos de valor para *quality cue* sabor

O atributo “comer” (25%) teve como principal consequência fundamental a “avaliação” (63%), com as ladders finalizando no mesmo valor terminal “prazer” (88%). Segundo os consumidores, se a carne tiver um sabor agradável dá vontade de comer de novo, devido à experiência agradável de consumo.

O atributo “churrasco” (25%) teve “saborosa” como principal consequência fundamental (63%), com as ladders finalizando nos mesmos valores “alegre” (100%) e “felicidade” (50%). Os participantes associam sabor ao churrasco, pois esse modo de preparo realça o sabor da carne bovina e normalmente representa um momento especial com a família.

O atributo “gosto” (25%) teve três ladders finalizando com o valor “prazer” (88%) e uma com “felicidade” (50%), com as ladders finalizando nos mesmos valores “alegre” (100%) e “felicidade” (50%). Esse atributo é decisivo para aumentar ou reduzir consumo da carne, pois traduz qualidade e o nível se satisfação pessoal após o consumo da carne bovina. Alguns consumidores relataram ser possível identificar pela aparência.

O atributo “ponto da carne” (13%) teve como consequências fundamentais “avaliação” (63%) e “altera consumo” (50%), como consequência psicológica teve “experiência de consumo” (63%) e finalizou nos valores “autocontrole” (50%) e “prazer” (88%). Para esse atributo há a preocupação com o ponto da carne, pois se for mal passada o consumo poderá ser reduzido, motivados pela preocupação com higiene e saúde, além disso, na percepção dos participantes, não gera uma boa experiência de consumo.

A importância do sabor da carne para os consumidores está de acordo com Malheiros et al. (2022), em que encontraram que carne com sabor intenso aumenta a probabilidade de compra e a disposição em pagar pela obtenção dessa característica.

4.3.5. Análise conjunta das Ladders

Considerando os mapas hierárquicos de valores para as *quality cues* cor, marmoreio, maciez e sabor, pode-se afirmar que o prazer foi o valor terminal comum à todas, podendo ser considerado, para essa amostra de consumidores, o valor mais relevante para escolha de *fresh* ou *cooked beef*. O destaque do prazer como principal valor relacionado à escolha da carne bovina está de acordo com (Garcia et al., 2018; Barrena & Sánchez, 2009), no entanto, para outras categorias de alimentos os consumidores brasileiros se demonstraram mais preocupados com segurança, saúde e sanidade (Marques et al., 2022; Durço et al., 2021.), caracterizando o consumo da carne como hedônico.

Em segundo plano, o senso de realização e a segurança também se destacam como valores terminais relevantes para carne bovina. O senso de realização está relacionado com atributos concretos diretamente vinculados ao consumo do produto, como sabor e maciez. Os consumidores que chegaram a esse valor se demonstraram preocupados com o ponto da carne, com textura, modo de preparo

adequado e em garantir uma boa refeição tanto para si mesmo quanto para as pessoas que estão servindo, especialmente em ocasiões de confraternização. Por outro lado, a segurança está mais atrelada a aspectos de sanidade e forma de armazenamento, de modo que os consumidores relataram preocupação com o tempo e temperatura de armazenamento, segurança do alimento e risco à saúde. A preocupação demonstrada com a sanidade e segurança do alimento está de acordo com Ling et al. (2021) e Chini et al., (2020), que relatam que consumidores de países em desenvolvimento se preocupam mais com esses aspectos em comparação a consumidores de países desenvolvidos.

Analisando pela ótica dos atributos concretos, pode-se afirmar que para as *quality cues* cor e marmoreio da *fresh beef*, o sabor aparece como atributo de destaque, podendo ser indicativo de que embora alguns consumidores se atenham às características físicas, de armazenamento, sanidade e saudabilidade, todos têm em comum a preocupação com o sabor que a carne terá, esses resultados são diferentes dos achados por Grunert et al. (2002), em estudo com consumidores irlandeses. Ou seja, ao comprar a *fresh beef* os consumidores participantes deste estudo ao visualizarem *quality cues* como cor e marmoreio já criam expectativas de como será essa carne para o consumo. Nesse sentido, o valor instrumental "autocontrole" que acompanha o atributo "sabor" está muito direcionado para escolhas assertivas que garantam a qualidade esperada daquela carne.

Considerando as *quality cues* maciez e sabor da *cooked beef*, obviamente atributos concretos diretamente relacionados ao consumo aparecem, no entanto, destaca-se a importância da ocasião de consumo e de como as características da carne podem mudar a participação em um evento, o que está de acordo com Aboah & Lees (2020). Ressalta-se ainda, que na ocasião de consumo as expectativas por carnes saborosas e macias são aumentadas, se não atendidas essas expectativas, a frustação gerada pode ser até maior do que em situações de consumo rotineiras. Outro ponto importante a se destacar é que a expectativa gerada é de realizar uma boa refeição com carne de qualidade, mas também em agradar convidados em situações de confraternizações ou lazer.

Assim, as *quality cues* de *fresh* e *cooked beef* se iniciam a partir de atributos com focos diferentes, mas finalizam com o mesmo valor comum, o prazer. De forma complementar, os valores segurança e senso de realização também possuem destaque para as duas situações de compra e se iniciam a partir de diferentes atributos. Essas informações podem ser utilizadas para explorar formas diferentes de comunicação com os consumidores de carne bovina.

4.4. Conclusão

O prazer é o valor comum a todas as *quality cues* estudadas e mais relevante para ser explorado tanto para *fresh* quanto para *cooked beef* na comunicação com os consumidores de carne bovina brasileiros. Comunicações remetendo a uma boa experiência de consumo, a melhor escolha para família ou para momentos de confraternização, alimento seguro e o destaque a características

desejáveis como maciez, sabor e suculência podem gerar aos consumidores motivação, identificação e auxiliá-los na decisão de compra.

Encontramos que para a carne bovina o consumo pode ser estimulado tanto por aspectos hedônicos quanto utilitários. O prazer e a segurança são dois motivadores para consumo hedônico da carne bovina, enquanto aspectos relacionados à saúde e a preocupações com teor de gordura justificam o consumo utilitário e podem ser moldados conforme educação dos consumidores sobre o real efeito de cada *quality cue* na carne e ao consumidor.

Considerando a relevância de cada *quality cue* estudada no processo de escolha da carne bovina, essas também podem ser exploradas de forma individual e direcionadas à criação de vínculo entre o consumidor e o alimento. Por exemplo, se o consumidor demonstra interesse pela coloração da carne porque entendem que essa *quality cue* informa sobre a segurança, no lugar de comunicar somente a coloração, cabe adicionar informações referentes ao tempo de armazenamento, temperatura de refrigeração, podendo até ser utilizadas tecnologias de embalagens inteligentes com indicadores de variações de temperaturas.

Em se tratando das *quality cues* maciez e marmoreio, a comunicação dos níveis desses atributos na forma de estrelas ou outros indicadores pode auxiliar os consumidores a nortear escolhas e conseguirem alcançar o senso de realização de uma alimentação com a qualidade desejada. Adicionalmente, recomenda-se o processo de educação dos consumidores sobre a contribuição que cada nível informado pode ter para a qualidade da carne para a qualidade da refeição, com menções ao incremento no sabor, textura e suculência, por exemplo.

A forma mais assertiva de se comunicar com um consumidor e estimular a escolha é fornecendo a eles carnes com informações que os permitam reconhecer os próprios valores pessoais. Portanto, recomenda-se a realização de estudos complementares que explorem outras *quality cues* intrínsecas e extrínsecas da carne bovina, como por exemplo suculência, tipo de corte, ponto da carne, marca e local de compra. Considerando que os hábitos regionais podem promover mudanças no comportamento dos consumidores, sugerimos que o presente estudo seja replicado utilizando amostras de consumidores de outras regiões brasileiras e, levando em consideração que no presente estudo utilizamos amostra por conveniência, recomendamos também a realização de estudos que utilizem a amostragem probabilística, visando auxiliar na representação completa da população brasileira. Os participantes desse estudo foram estimulados visualmente, sugerimos a realização de estudos que estimulem os consumidores antes da entrevista em profundidade, podendo ser através da visualização da carne in natura para *quality cues* da *fresh beef* e através de testes sensoriais para *quality cues* da *cooked beef*.

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Apêndices

Apêndice A. Imagens de padronização e tabelas com descrição detalhada das *ladders*.

Figura 1: Estímulo visual utilizado para calibração dos participantes sobre as quality cues estudadas.

Tabela 2: Relação numérica de cada dimensão explorada no mapa hierárquico de valor para quality cue cor (Figuras 2 A e B)

Atributo Concreto	**Consequência funcional**	**Consequência psicológica**	**Valor instrumental**	**Valor terminal**
(1) Sanidade	(5) Gordura	(13) Qualidade	(16) Responsável	(19) Prazer
(2) Sabor	(6) Tempo de armazenamento	(14) Experiência de consumo	(17) Capaz	(20) Segurança
(3) Armazenamento	(7) Oxidação	(15) Expectativa	(18) Autocontrole	
(4) Vermelho vivo	(8) Sabor			
	(9) Idoneidade			
	(10) Refrigeração			
	(11) Risco à saúde			
	(12) Higiene			

Tabela 3: Descrição completa das relações geradas no mapa hierárquico de valor da quality cue cor (Figuras 2 A e B).

Sanidade	1-11-12-20	A sanidade da carne pode representar risco à saúde e está diretamente relacionada com o nível de higiene do estabelecimento. Está relacionada com a segurança do alimento e dá desânimo de comprar.
	1-7-6-16-20	Sanidade pode mudar conforme a oxidação, que varia de acordo com o tempo de armazenamento no ponto de venda. O alto tempo de armazenamento pode gerar proliferação de microorganismos e isso gera medo de intoxicação.
	1-10-16-20	A sanidade da carne pode ser alterada conforme o nível de refrigeração, que corre risco de ser inadequada durante o transporte ou armazenamento no ponto de venda, e podem ser responsáveis por características indesejáveis da carne. A refrigeração inadequada pode comprometer a segurança do alimento.
	1-11-16-20	A sanidade pode ser avaliada pela alteração na coloração, de modo que carne estragada tem coloração escura, pode apresentar risco à saúde, gerar despedícios, causar frustração e indignação, comprometendo a segurança do alimento.
	1-5-6-13-16-20	A sanidade pode ser avaliada pela alteração na coloração, de modo que carne com aparência boa tem coloração avermelhada e a gordura não tem coloração muito escura, essas cores e aroma alterados são indicadores que se alteram conforme o tempo de armazenamento e são indicativos da qualidade da carne.
	1-11-13-16-20	Em alguns casos podem ser utilizados aditivos para disfarçar a coloração marrom da carne. Isso representa risco à saúde tanto pelo consumo não intencional de aditivos quanto pelo risco de consumir uma carne fora da validade, com qualidade ruim. Evitar consumo de alimentos não saudáveis e que podem comprometer a qualidade de vida.
	1-9-12-8-13-16-20	Uma carne mais nova tende a ter melhor idoneidade, devido principalmente a higiene do estabelecimento, ao menor tempo de armazenamento e menor crescimento microbiano. Assim, a carne pode ter melhor sabor e maior qualidade esperada.
Sabor	2-5-13-15-18-19	O sabor da carne depende de uma aparência boa (carne vermelha) e teor de gordura, na forma de marmoreio ou gordura de cobertura. Uma carne saborosa é de boa qualidade e aumenta expectativas na momento do consumo.
	2-5-18-19	A presença de gordura ajuda a melhorar o sabor, textura e aparência da carne.
Armazenamento	3-7-8-10-14-16-19	O menor tempo de armazenamento ajuda a evitar oxidação lipídica e alterações no sabor da carne. A refrigeração adequada também é necessário para manutenção dessas caracteríticas inalteradas. Comprar carne nova é hábito familiar e proporciona uma melhor experiência de consumo.
	3-6-13-16-20	O tempo de armazenamento interfere na qualidade da carne de acordo com o tipo de embalagem, por exemplo, embalagem à vácuo não compromete a qualidade microbiológica e permite melhoria sensorial através da maturação, garantindo melhor qualidade.
	3-10-12-11-16-20	O armazenamento adequado depende da refrigeração. A distribuição de carne no Brasil depende de muitos ou longos transportes, o que pode apresentar um risco sanitário e à saúde. Esse controle é i portante para manutenção da segurança do alimento.

Vermelho vivo	4-6-9-11-14-15-18-20	Uma carne com vermelho-vivo me dá a impressão de ter menor tempo de armazenamento (carne nova), de ser alimento idôneo para consumo e com menor risco de intoxicação alimentar. É um alimento que me dá vontade de comprar, crio expectativa para consumir e considero um alimento que respeita a vida do animal e o trabalho dos profissionais envolvidos na criação.
	4-5-8-13-14-17-19	Uma carne com coloração vermelho-vivo com marmoreio é mais suculenta e saborosa. Escolho esse tipo de carne porque é o melhor para minha família, garante qualidade e uma boa experiência de consumo.
	4-9-7-14-16-20	A carne com cor vermelho-vivo é fresca e boa para consumo, sendo idônea e com menor risco de rancidez, gerando uma boa experiência de consumo.

Tabela 4: Relação numérica de cada dimensão explorada no mapa hierárquico de valor para quality cue quality cue marmoreio (Figuras 3 A e B).

Atributo Concreto	**Atributo Abstrato**	**Consequência funcional**	**Consequência psicológica**	**Valor instrumental**	**Valor terminal**
(1) Maciez	(3) Facilidade de consumir	(5) Gordura	(8) Satisfação	(15) Capaz	(18) Respeito próprio
(2) Sabor	(4) Bom	(6) Mastigação	(9) Encontros afetivos	(16) Autocontrole	(19) Senso de realização
		(7) Consumo	(10) Felicidade	(17) Alegre	(20) Prazer
			(11) Frustração		
			(12) Expectativa		
			(13) Lazer		
			(14) Experiência de consumo		

Tabela 5: Descrição completa das relações geradas no mapa hierárquico de valor da quality cue marmoreio (Figuras 3 A e B).

Maciez	1-3-6-7-8-17-20	A carne macia é mais fácil de consumir, pois não precisa fazer força para mastigar, não enrosca nos dentes, facilita a digestão e me deixa satisfeito com a qualidade.
	1-3-8-10-17-20	Uma carne macia é mais fácil de consumir porque é mais saborosa e eu sinto prazer e felicidade quando consumo.
	1-3-8-10-15-19	A carne fica macia e fácil de consumir quando a carne está no ponto certo. Me sinto satisfeito quando acerto o ponto, consigo fazer um bom trabalho e agradar a todos que estão consumindo a refeição que foi preparada.
	1-6-8-10-16-20	A carne não macia dificulta o consumo, pois não despedaça com a mastigação e faz com que a carne não seja saborosa. Carne com essas características trazem insatisfação e não deixam feliz ao consumir.
	1-5-7-10-13-17-20	A maciez e sabor da carne depende do teor de gordura e do tipo de ocasião de consumo (ocasiões especiais), são produtos de luxo e me trazem a sensação de recompensa, me sinto realizado e feliz ao consumir carnes com marmoreio. Esse consumo normalmente acontece em momentos de lazer e encontros afetivos.
	1-6-7-11-13-16-18	A carne sem maciez faz com que seja necessária muita mastigação, gerando incômodo nos dentes e acúmulo de fibras, fazendo com que meu consumo seja reduzido e gere desperdício. Esse tipo de carne me gera frustração e atrapalha meu momento de lazer.
	1-7-14-16-20	Uma carne macia é mais agradável ao paladar (consumo) e depende do modo de preparo correto, trás a sensação de carne bem feita e gera uma boa experiência de consumo.
	1-7-9-14-13-16-20	Carne sem maciez é resultado do modo de preparo errado e tem sabor ruim, não é agradável de comer e reduz consumo. Ao comprar um alimento tento sempre fazer a escolha certa, para valorizar o meu dinheiro, se o consumo for em casa eu fico triste mas não reclamo pois tem o lado afetivo. Não tenho vontade nem prazer de comer, afeta meu momento de lazer.
	1-6-14-16-20	Carne sem maciez (dura) causa incômodo e dificuldade de mastigar, é uma carne que não vale a pena consumir e compromete a experiência de consumo.
	1-14-13-8-11-17-20	O consumo de carnes macias e de qualidade normalmente acontece em ocasiões de festas, é imprescindível comer por prazer, especialmente durante o momento de lazer. Ao consumir uma carne macia vem a sensação de compra certa e fico satisfeita com a escolha que fiz, especialmente pelo preço. Se a escolha da carne for errada gera chateação e frustração.

	1-7-6-5-14-12-10-11-15-19	Se a carne está macia é agradável de comer, mesmo que o sabor não seja marcante, pois facilita a mastigação. O maior teor de marmoreio contribui para maciez e para experiência de consumo agradável. Se a carne teve o modo de preparo adequado e tem as características desejáveis, cria expectativa de um bom sabor, maciez e mastigação. Fico feliz quando compro e preparo a carne e fica do jeito que esperava, mas se der errado me sinto frustrado e decepcionado.
Sabor	2-4-7-16-18	Carne com sabor bom dá vontade de comer de novo, mas é necessária contrapartida preço x qualidade.
	2-7-14-11-16-18	Se o sabor de uma carne for ruim, não como novamente, restrinjo consumo e deixo de comprar, pois aquele alimento não traz prazer, traz experiência de consumo ruim e gera frustação em pagar caro e o sabor ser ruim.
	2-4-14-16-20	Sabor bom define se o investimento feito na carne valeu a pena. Se for um alimento de qualidade e com modo de preparo correto é esperado uma experiência de consumo agradável.
	2-4-5-14-12-9-17-20	Carne com gordura tem o sabor melhor, gerando uma boa e agradável experiência de consumo. Espero sempre que o alimento tenha a melhor qualidade possível, especialmente em situações que vou estar com as pessoas que eu gosto.

Tabela 6: Relação numérica de cada dimensão explorada no mapa hierárquico de valor para quality cue quality cue maciez (Figuras 4 A e B).

Atributo Concreto	**Atributo Abstrato**	**Consequência funcional**	**Consequência psicológica**	**Valor instrumental**	**Valor terminal**
(1) Tempo de armazenamento	(6) Comida molhada	(7) Enzimas da maciez	(16) Experiência de consumo	(18) Intelectual	(22) Sabedoria
(2) Carne chiclete		(8) Gordura	(17) Expectativa	(19) Alegre	(23) Senso de realização
(3) Suculência		(9) Facilidade de mastigar		(20) Lógico	(24) Segurança
(4) Textura		(10) Carne macia		(21) Capaz	(25) Prazer
(5) Gordura		(11) Sabor			
		(12) Altera consumo			
		(13) Modo de preparo			
		(14) Ponto da carne			
		(15) Mais marmoreio			

Tabela 7: Descrição completa das relações geradas no mapa hierárquico de valor da quality cue maciez (Figuras 4 A e B).

Tempo de armazenamento	1-7-18-22	O tempo de armazenamento contribui para alteração das fibras devido a ação das enzimas da maciez.
Carne chiclete	2-9-11-16-21-25	Carne chiclete é uma carne dura que não corta bem, causa dificuldade de mastigar e engolir, perde sabor e textura comprometendo a experiência de consumo.
	2-11-13-16-17-21-25	Carne chiclete compromete a textura e o sabor, mas depende do modo de preparo e tipo de corte. Compromete a boa experiência de consumo e o prazer de uma boa alimentação.
Suculência	3-6-8-9-12-21-23	Uma carne com suculência garante comer uma comida molhada, deve ter a presença de gordura que gera facilidade de mastigar e aumenta o consumo (dá vontade de comer).
	3-11-9-10-16-17-19-25	A suculência da carne confere melhor sabor, facilidade de mastigar e dá sensação de que a carne está macia. Carnes com essas características são consumidas em reuniões e comemorações, pois geram a expectativa de que são mais prazerosos de comer.
	3-8-14-16-21-23	A suculência disfarça a maciez, o teor de gordura contribui para suculência e alteração da textura. O ponto da carne deve ser mal passada para ter efeito positivo. Confere uma boa experiência de consumo, pois gera um sabor bom na boca. Ao escolher carne assim sinto que consegui aplicar meus conhecimentos.
Textura	4-6-9-12-10-8-16-17-21-25	A carne com textura de comida molhada gera facilidade de mastigar por ser macia e aumenta consumo. Presença de gordura contribui. A carne não gruda no dente, tem uma boa experiência de consumo porque não precisa ficar muito tempo mastigando a mesma coisa e gera a expectativa de comer uma carne mais saborosa.
	4-11-14-17-21-25	O sabor varia de acordo com o ponto da carne e o tipo de corte. Ao ver a textura da carne já imagina como será o consumo e pela aparência da carne crua imagina como ela vai ficar cozida.
Gordura	5-10-21-25	A gordura (marmoreio) deixa a carne mais macia e com melhor sabor, normalmente consumidas em um almoço diferente.
	5-6-10-13-14-20-25	A gordura (marmoreio) contribui para a sensação de comer comida molhada, conferindo maior maciez para carne. Esse efeito é dependente do modo de preparo, ponto da carne, tipo de corte.

Tabela 8: Relação numérica de cada dimensão explorada no mapa hierárquico de valor para quality cue quality cue sabor (Figuras 5 A e B).

Atributo Concreto	**Atributo Abstrato**	**Consequência funcional**	**Consequência psicológica**	**Valor instrumental**	**Valor terminal**
(1) Comer	(5) Ruim	(7) Avaliação	(13) Aprendizado	(18) Responsável	(21) Felicidade
(2) Churrasco	(6) Bom	(8) Tipo de tempero	(14) Frustração	(19) Autocontrole	(22) Prazer
(3)Gosto		(9) Confraternização	(15) Momento especial	(20) Alegre	
(4) Ponto da carne		(10) Saborosa	(16) Satisfação		
		(11) Qualidade	(17) Experiência de consumo		
		(12) Altera consumo			

Tabela 9: Descrição completa das relações geradas no mapa hierárquico de valor da quality cue sabor (Figuras 5 A e B).

Comer	1-7-17-22	Se a carne tiver sabor bom dá vontade de comer de novo, porque proporciona uma boa experiência de consumo.
	1-15-20-22	Comer representa um momento especial de relaxamento e tranquilidade para recarregar as energias.
	1-7-10-11-12-8-22	A alimentação tem que ser saborosa, bem feita e de qualidade para aumentar consumo. Modo de preparo e tipo de tempero são determinantes para alterar o consumo.
Churrasco	2-10-15-20-21	Churrasco representa um dia diferente, essa forma de preparo deixa a carne mais saborosa, pois evidencia o sabor da carne bovina e é diferente das demais. É um momento especial porque estou matando a saudade da família e tenho a possibilidade de acompanhar todo o processo de preparo (ritual).
	2-10-11-17-14-20-21	Churrasco representa festa, com oportunidade de comer carnes saborosas e de melhor qualidade. Para uma boa experiência de consumo é importante que as carnes tenham sabor bom nessas ocasiões. Se as expectativas não são atendidas geram frustração.
Gosto	3-6-7-12-11-16-20-21	A carne ter gosto bom é decisivo para gostar ou não da carne e aumenta consumo, pois tem alta qualidade. Consumir carne com sabor bom trás satisfação pessoal.
	3-5-12-19-22	Se a carne tiver gosto ruim diminui o consumo, como abaixo do necessário para ficar satisfeito.
	3-17-19-22	Carne com gosto forte desperta vontade de experimentar, pois a experiência de consumo será melhor do que consumir uma carne com sabor fraco.
	3-14-13-22	O gosto da carne pode ser previsto pela aparência, mas se a escolha for errada gera frustração e aprendizado para não repetir uma compra errada. Evitar frustração está diretamente relacionado ao prazer de comer.
Ponto da carne	4-7-12-17-19-22	Se o ponto da carne for mal passada dá a sensação de comer a carne semi-crua e reduzo consumo, por sentir aflição e preocupação com higiene e saúde. Não me agrada e não gera uma boa experiência de consumo.

5. CONCLUSÃO

Ao escolher uma carne bovina, os consumidores brasileiros podem encontrar na embalagem *quality cues* regulamentadas ou estratégicas, que variam entre *fresh* e *cooked beef*. Considerando o status regulatório do Brasil, as *quality cues* regulamentadas se concentram em aspectos obrigatórios de caracterização e identificação do alimento, assim como aspectos nutricionais e de saudabilidade. Isso demonstra que há oportunidade de desenvolvimento de regulamentações que orientem a comunicação de *quality cues* intrísecas relacionadas à qualidade sensorial da carne.

Esse tipo de padronização partindo de órgãos reguladores oficiais pode possibilitar a diferenciação de produtos para o atendimento das exigências de distintos *clusters* de consumidores. Adicionalmente, pode viabilizar a diferenciação dos produtos em preço e gerar maior rentabilidade para produtores de tipos específicos de carne, visto que há consumidores brasileiros que se demonstram dispostos a pagar para obter uma carne com *quality cues* desejadas. Pensando em escolha do consumidor, a padronização para utilização de *quality cues* que remetam aos aspectos sensoriais da carne bovina pode evitar que marcas utilizem comunicação indevida que os induzam ao engano ou erro.

Atualmente, são exploradas como *quality cues* estratégicas raça e marmoreio, no entanto, para a amostra estudada encontramos que essas informações não são as principais determinantes para escolha, em alguns casos não são visualizadas ou ainda podem diminuir a probabilidade de escolha. Por outro lado, *quality cues* como sabor, cor e maciez podem aumentar a probabilidade de escolha pois agregam aos consumidores oportunidade de alcançar valores pessoais como prazer e segurança. Cabe ressaltar que os consumidores tendem a aumentar a atenção visual nas *quality cues* conhecidas, nesse contexto, o maior ponto de atenção levantado é que sejam comunicadas *quality cues* compreensíveis e que auxiliem os consumidores na escolha. Para isso, é necessário que ocorra um processo de educação do consumidor sobre a contribuição de cada *quality cue* nas carcaterísticas da carne, sobretudo as sensoriais.

Tomando como base a complexidade envolvida no comportamento de consumidores, para atender às exigências é necessário compreender como as *quality cues* são interpretadas por eles e quais valores pessoais norteiam suas escolhas. Para isso, além da educação dos consumidores, é importante que a comunicação não se atenha somente às *quality cues* físico-químicas da carne, mas também comunique sobre os benefícios adicionais, fazendo com que seja criado maior envolvimento com a carne bovina e que ao escolher aquele produto todas as demandas sejam atendidas, inclusive os valores desejados.

A forma mais assertiva de se comunicar com um consumidor e estimular a escolha é fornecendo a eles carnes com informações que eles são capazes de interpretar e utilizar na escolha e que os permitam reconhecer os próprios valores pessoais. Considerando que existem inúmeros fatores que interferem no comportamento do consumidor, dentre eles hábitos alimentares culturais e regionais,

estudos com consumidores de outras regiões brasileiras são recomendados. Considerando a amostra de consumidores da região sudeste brasileira, identificamos que há diferenças de motivações e comportamento em relação à consumidores de países desenvolvidos.