



## The effect of Covid-19 on the purchase intention of certified beef in Brazil

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### ABSTRACT

Some events in recent years have weakened consumers' trust regarding food safety in a number of countries, including bird flu, hormones and residue of veterinary medicine in meat and, more recently, Operation Weak Flesh. COVID-19 also led to a focus on the urgent need to seek strict production standards that ensure food safety. In this scenario of uncertainty, traceability and certification could be useful tools to improve the perception of trust and safety in production processes. Thus, the aim of this study is to analyze the effect of the COVID-19 pandemic on the purchase intention of certified beef. A quantitative study was conducted with 862 Brazilian consumers. The data were treated using structural equation modeling. The results show that the level of subjective knowledge of certification is related to the importance attributed to traceability and purchase intention. The concern towards legality of slaughterhouses and to traceability was shown to be related to purchase intention. Furthermore, the higher the level of concern over COVID-19, the more important the influence of traceability becomes with regard to meat purchase intention.

### 1. Introduction

Some events in recent years have weakened consumers' trust regarding food safety in a number of countries, including bird flu (Cunha & Moura, 2008), hormones and residue of veterinary medicine in meat (Verbeke, Frewer, Scholderer, & De Brabander, 2007), and, more recently, Operation Weak Flesh, conducted by the Brazilian Federal Police in 2017 (Quevedo-Silva, Freire, & Spanhol-Finocchio, 2020). These events highlight the concept of food safety and cause consumers to reflect on the consumption of food product. This not only affects retailers, but the entire meat production chain.

The development of crises like these leads to a stronger dialogue between governments, industries that supply the world with food, and leaders of agri-food chains in an effort to implement unique policies to reduce health risks. According to Henschioni, Mccarthy, and Resconi (2017), attributes that attest to the quality of meat include price, certification, brand, appearance, origin, animal welfare, production system, nature/organic, health and nutrition, safety, environmental issues, traceability, race and processing technologies. It is understood that some

of these factors might not only attest to quality but could also help to create a greater perception of safety, especially those attributes related to certification and traceability.

Traceability in food production means the ability to trace and monitor food products at every stage of their production and distribution (Kehagia, Linardakis, & Chrysochoidis, 2007). Through traceability, it is possible to inform the consumer of the health, quality, safety and control features of a food product, leading to greater trust and confidence (Van Rijswijk, Frewer, Menozzi, & Faioli, 2008; Wang & Tsai, 2019).

Knowing the future challenges of food supply for the world population and people's greater willingness to consume safe socially and environmentally valued products, it is necessary to study meats that appeals to people because they are produced efficiently, with a low environmental impact and regard for animal welfare. With these characteristics, we accordingly have the concept for sustainable meat produced in the tropics in a system of crop-livestock-forest integration (CLFI) (Alves, Almeida, & Laura, 2015). The production of beef cattle in a wooded environment, integrated with other chains, such as grains and

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lumber, support the concept of Carbon Neutral Meat (CNM), a traceable and certified production differential.

Providing consumers with more information could reduce information asymmetry and perceived risk (Dandage, Badia-Melis, & Ruiz-García, 2017), although traceability and certification do not always have the expected effect on consumers. Some factors moderate this relationship, such as the amount of knowledge of the subject (Zhang, Bai, & Wahl, 2012), the amount of information provided on labels (Sander, Semeijn, & Mahr, 2018), and the level of trust in labels (Liu, Gao, Nayga, Snell, & Ma, 2019). In that matter, according to Menozzi and Finardi (2019), the effect of trust in labels, such as protected designation of origin, made consumers, in spite of alarms and scaring images shown by the media, not to perceive the food safety concerns. This shows that despite the potential of traceability as a marketing tool and the importance given to food safety, the weight it carries in the decision making process can vary from one consumer to another due to their ability to use or even understand this extra information that is provided.

In this scenario of the growing importance of food safety, according to Mussell, Bilyea, and Hedley (2020), COVID-19 led to an even greater focus on the urgent need to seek strict production standards that ensure food safety. One of the major changes that took place in the USA and Canada was people stockpiling items, and this led to glitches in the food supply chain, which was affected, among other reasons, by interruptions at production plants in a number of countries because employees were infected. Food import and export transactions were affected by the pandemic. East Asian consumers suffered most from breaks in the food supply chain, with a shortage of products like meat in early March 2020. Canadian and American agents were deeply concerned over the closure of slaughterhouses and meat processing plants in Brazil and overseas. Their main concern was to guarantee the maintenance of animal health and welfare protocols in chains affected by the crisis.

In this scenario of uncertainty, traceability and certification could be used as tools to increase perceived trust and safety in the production process (Hobbs, Bailey, Dickinson, & Haghiri, 2005; Wang & Tsai, 2019). Therefore, the aim of this study is to analyze the effect of the COVID-19 pandemic on the purchase intention of certified beef. The study contributes to the field by proposing and testing a purchase intention model with factors related to the production process and ensuring food safety, consumers' knowledge levels and the moderating effect of their concern/fear during the COVID-19 pandemic.

### 1.1. Conceptual development

Consumers' response to crisis situations like the COVID-19 pandemic can be understood through risk perception. According to Pennings, Wansink, and Meulenberg (2002), the greater the perceived risk, the more consumers tend to engage in activities that reduce this risk. Regarding beef consumption patterns, the effect of risk perception can be even greater, since quality assessment mainly occurs during consumption, as there are not always ways to confirm the safety level prior to purchase/consumption (Angulo & Gil, 2007). Despite this, some features can be used to make this process safer, such as food brands and certifications, which can provide relevant information with more guarantees for the consumer (Grunert, Bredahl, & Brunso, 2004).

Another point to consider is that although meat is a form of hedonistic behavior and distinction for many people in the western world, the effect of the volume of protein consumption on human health is also a cause for concern, along with its association with certain diseases, ethical problems regarding the breeding and slaughter of animals and problems linked to the environmental impact of production (Ruby et al., 2016).

In this context, certification could be an attribute related to product quality and safety when it comes to choosing beef (Aprile, Caputo, & Nayga Jr., 2012). Certifications available on the market include Carbon Neutral Meat (CNM) (Alves et al., 2015). According to the authors, the purpose of this certification is to assure the end consumer that certified

products have neutralized or reduced carbon emissions, according to criteria set by the Brazilian Agricultural Research Corporation (Embrapa). In addition to good farming practices, the certification guarantees compliance with the applicable socio-environmental legislation for each product or raw material, as well as the quality of the end product.

The use of crop-livestock-forest integration (CLFI) systems for the production of meat, grains and wood is a reality in Brazil. The advantages of CLFI include sustainable intensified land use, diversity in production, soil conservation, better use of inputs and natural resources, less pressure to open new areas (earth-saving effect), animal welfare, carbon sequestration, and lower gas emissions (Alves et al., 2015).

Another attribute related to safe beef purchases and consumption is traceability. According to Verbeke and Ward (2006), as well as a guarantee of quality, traceability potentially adds more value in the eyes of consumers. According to the authors, including information on quality and safety on the label can have a positive effect on consumers, and this could have even greater potential by adding guarantees of traceability.

Some research has been conducted on beef consumers' behavior and preferences and their willingness to pay more for labeled products with information on traceability and different kinds of quality guarantees (Chen & Huang, 2013; Menozzi, Halawany, Darson, Mora, & Giraud, 2015; Song, Wang, & Hu, 2017). In general, traceability helps to strengthen consumers' trust in the entire food system as a means of attesting to quality guarantees (Hobbs, 2016). Knowing about the animal's origins is an important quality attribute that inspires consumers' trust in the safety of the food they consume with a guarantee that it is good for their health.

Wu, Xu, and Gao (2011) empirically showed that after the consumers were fully informed about a food traceability system, their acceptance level for certified traceable food significantly increased. Besides that, the majority of consumers stated that they would be willing to pay extra for traceable food. According to Bosona and Gebresenbet (2013), consumers usually consider that quality and safety assurance supported by traceability system are important and they are willing to pay a higher price for such quality and safe food product.

Menozzi, Halawany-Darson, Mora, and Giraud (2015) recall that different perceptions are manifested on traceability because they vary according to the kind of product and depend on the level of processing. The fresher the product, the more weight the traceability system used will carry in quality assessment. The information asymmetry and barriers perceived by consumers regarding access to information heighten the notion of risk and diminish trust, and consumers seek informative labels and certification from producers, retailers and other sources (Lobb, Mazzocchi, & Traill, 2007; Mazzocchi, Lobb, Bruce Traill, & Cavicchi, 2008; Stefani, Cavicchi, Romano, & Lobb, 2008).

Thus, the following hypothesis may be stated:

**H1.** Concern towards traceability positively affects meat purchase intention.

The recent awakening of the consumer with regard to issues related to agricultural practices, animal protein production, concern over the slaughter of animals and food safety has led to research involving individuals and certain products to reveal their purchase intentions in an attempt to predict current and future consumer behaviors. In the specific case of the work of Verbeke and Vackier (2004), the levels of involvement of Belgian consumers with meat were measured, finding that all those who claimed to be meat consumers are greatly interested in tangible quality attributes (flavor). Among those with higher levels of involvement with the product, intangible attributes are a better way of determining their purchase intentions (seals, authenticity and food safety).

According to Mussell et al. (2020), the COVID-19 pandemic further increased the sector's concern over its production processes, especially a guarantee of products that do not pose a risk to consumers' safety. The suspicion that slaughterhouses could cause an outbreak of the disease

led to the closure of slaughterhouses and meat processing plants in Brazil and overseas.

It is necessary to guarantee the maintenance of animal health and welfare protocols in the chains affected by the pandemic (Mussell et al., 2020), and this concern does not only affect regulation agencies but also the consumer market. Companies that provide evidence that their slaughter process follows adequate standards are expected to feel a lower negative impact on consumption.

From a consumer behavior perspective, studies on food fraud are appropriate when the research focuses on perception and attitude regarding food safety, perception of food authenticity, attitude to what is and not authentic and trust in institutions and specialists. Trust in the actors involved in such complex agri-food systems is founded on transparent operations with efficient communication. Actors in the food supply chain use signs to convey trust through their attention to legality (laws, investing in certification, identifying the origin of food and attention to consumers' requirements, such as fair trade suppliers and organic certificates). According to the study by Kendall et al. (2019), it was discovered that a perception of non-compliance with legislation and fraud in food chains is, among other justifications, associated with disdain for good production practices by the agents in the chain e.g., food producers. Concern towards legality positively impacts consumer intention. Non-compliance is interpreted as a malevolent attitude and abuse of power by agents in the chain. The lack of trust triggers concerns related to animal welfare and the safety of the food that is produced and marketed. Misleading labels lead to mistrust, with consumers doubting the integrity of every agent.

In this respect, the study of Burnier, Spers, and Guerra (2020) presents the concept of legality, which includes consumers' perceptions regarding the ability of farmers and slaughterhouses to obey labor laws and provide adequate working conditions. Therefore, amidst the COVID-19 pandemic, these aspects are expected to be even more important to consumers.

**H2.** Concern towards legality has a positive impact on meat purchase intention.

Although certifications and traceability enable greater consumer trust in the quality and safety of beef, studies have shown that many consumers do not make use of the information printed on the label due to a lack of understanding (Liu, Hoefknes & Verbeke, 2015), a low perception of its utility or little trust in the information (Cornish & Moraes, 2015).

In the study of Sander et al. (2018), it was shown that when consumers are given too much information, often with many numbers and hard to interpret, their trust diminishes and they decide to let their purchase be guided by price rather than opting for information on quality attributes.

The consumer's knowledge of certification/labeling/origin of meat has a positive effect on trust and intention to purchase certified products (Pardo, Jiménez, & Pérez-Villarreal, 2015). Consumer knowledge is defined as the set of information available to the consumer during a purchase decision (Brucks, 1985). Some studies differ between what the consumer actually knows, which is called objective knowledge, and what he believes he knows, referred to as subjective knowledge (Aertsens, Mondelaers, Verbeke, Buysse, & Van Huylenbroeck, 2011; Carlson, Vincent, Hardesty, & Bearden, 2009; Rodrigues, Pereira, Silva, Mendes, & Carneiro, 2017). Objective knowledge includes accurate information on a certain product lodged in consumers' long-term memories, while subjective knowledge is how much a consumer believes he knows or possesses information about the product (Gurhan-Canli, 2003; Park, Mothersbaugh, & Feick, 1994).

Consumers with greater subjective knowledge of a product tend to feel less confused and more confident in their choices, which impacts their decisions (Jin et al., 2014). According to research by Aertsens et al. (2011) with food consumers, higher levels of subjective knowledge of organic food are positively related to a more positive attitude towards

these products, greater experience with them and more frequent use of information.

Furthermore, high subjective knowledge levels can lead to more environmentally sustainable food choices (Peschel, Grebitus, Steiner, & Veeman, 2016). According to the authors, around 20% of consumers are prepared to use information on labels in their food choices and 10–20% could use it if they improved their level of subjective knowledge. A systematic review showed that an adequate nutritional knowledge is essential determinant to drive the behavioural change towards a more sustainable diet (Biasini et al., 2021), demonstrating the importance of this factor in the decision making process.

Therefore, it is expected that:

**H3.** Subjective knowledge positively impacts the concern towards traceability.

**H4.** Subjective knowledge positively impacts meat purchase intention.

Food crises stress the need for transparent food systems, attributing new responsibilities to agents in every link of the production chain. Access to different kinds of information on production, details of the processing phases and guarantees regarding distribution are examples of traceability actions, enabling the identification of the origin of food from production to its arrival on the market.

Traceability is a means of bolstering consumer trust in agri-food systems. Engaging consumers in marking choices that aid their well-being is related to the perceived safety of products available on the market. However, Badia-Melis, Mishra, and Ruiz-García (2015) warn that the negative consequences of food scandals lead consumers to feel insecure and demonstrate that many food chains show disdain when it comes to integrating and providing information necessary to mitigate flaws and increase trust on the part of agents and end consumers.

Likewise, studies have shown that information on the origin of food products has a positive impact on purchase intention (Bitzios, Lisa, Krzyzaniak, & Mark, 2017; Gellynck, Verbeke, & Vermeire, 2006; Menozzi et al., 2015; Van Rijswijk & Frewer, 2012). However, it should be noted that information on product labels obtained through tracing systems could be interpreted differently by end consumers because the importance of traceability depends on the notion of risk and safety attributed by consumers to the food they consume.

The COVID-19 pandemic has consequences for people's health, but also their trust in consuming certain kinds of food. In the case of beef, also due to cases reported in the news of outbreaks of diseases at slaughterhouses, this effect could be even greater, meaning that the attributes that ensure food safety, such as certifications and guaranteed traceability, will become even more important in consumers' decision making processes.

Consequently, the following research hypothesis may be given:

**H5.** Fear of COVID-19 positively moderates the relationship between concern towards traceability and meat purchase intention.

Based on the literature review for the present study, the following model is proposed (see Fig. 1):

## 2. Material and methods

This study, which is quantitative and descriptive in nature, included variables related to the evaluation and purchase intention of certified meat during the COVID-19 pandemic. For this purpose, a survey was developed and operationalized using an online data collection tool (SurveyMonkey) completed by a sample of 862 consumers from all over Brazil. The link was activated and managed throughout May 2020 by a company that specializes in market research and has a panel of consumers all over the country.

The target population of the study was made up of consumers responsible for purchasing beef. The sample was characterized as non-probabilistic (Hair, Black, Babin, & Anderson, 2010). However, the data were collected according to the proportional distribution of per

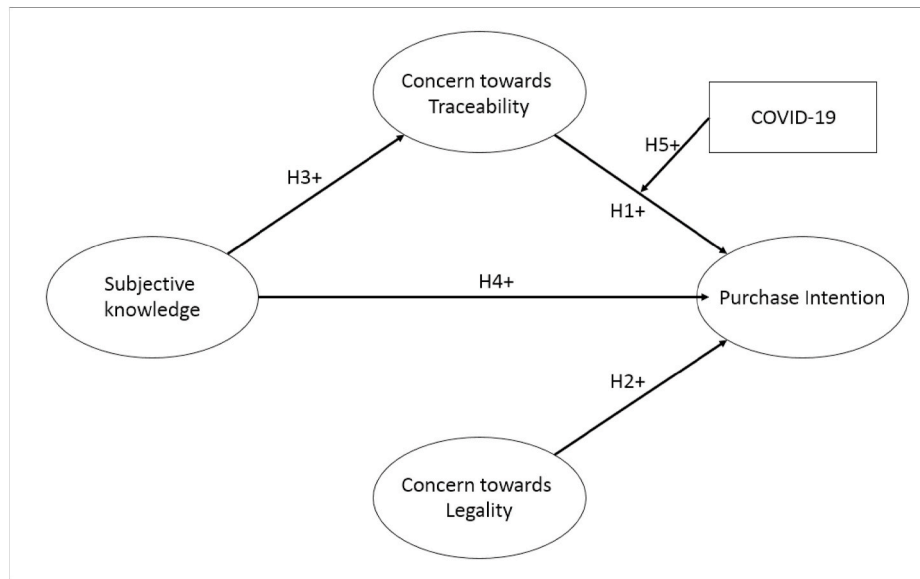


Fig. 1. Research model.

capita consumption of beef all over the country, in accordance with Family Budget Research 2009 (IBGE, 2010), to ensure that the data were more valid and representative. The demographic characteristics of the consumers who participated in this study and the population data are shown in Table 1.

A total of 1000 questionnaires were collected, of which 862 were deemed valid. Of these 862 valid questionnaires, 38% were completed by respondents from the Southeast region of Brazil, 24% from the Northeast, 20% from the South, 10% from the North and 8% from the Midwest. When comparing with population data, the sample has more young consumers with a higher educational level.

When any form of response bias was detected in accordance with the methodology proposed by Freire, Senise, dos Reis, and Ono (2017), the questionnaires were excluded from the study. To gauge the existence of common method variance, Harman’s single factor test was performed, using (unrotated) principal component exploratory factor analysis, in which all the indicators are clustered into a single dimension. As the generated factor presented a variation of only 37.85%, below the critical limit of the test (50%), it was possible to conclude that the study did not suffer from this bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

Table 1  
Demographic characteristic.

Characteristics	Sample	Population <sup>a</sup>
Sex		
Female	52%	49%
Male	48%	51%
Age (years)		
18–29 years	24%	48%
30–49 years	39%	47%
50 + years	37%	5%
Education		
Primary school	40%	3%
High school	32%	47%
University	21%	50%
Region		
North	9%	10%
Northeast	27%	24%
Southeast	42%	38%
South	14%	20%
Midwest	8%	8%

<sup>a</sup> Data from IBGE (2020).

### 2.1. Measurement scales

To measure the fear of consuming meat due to the COVID-19 pandemic, an item was measured on a 7-point Likert scale, ranging from 1 (Totally disagree) to 7 (Fully agree): ‘A health crisis has been caused by the coronavirus and today I am afraid to eat beef’. To measure the concern towards traceability and legality constructs, the scale of Burnier et al. (2020) was used, both comprising four items. The level of subjective knowledge of certification was measured using a scale adapted from Gurhan-Canli (2003), comprising three items. Purchase intention was measured using a scale adapted from Kozup, Creyer, and Burton (2003), comprising four items. All the items on these scales were measured using a 7-point Likert scale, ranging from 1 (Totally disagree) to 7 (Fully agree).

Before measure purchase intention the CNM certification was presented to respondents. This certification assures consumers that certified products have neutralized or reduced carbon emissions, good farming practices, quality and compliance with the applicable socio-environmental legislation.

### 2.2. Data analysis technique

Owing to the different independent variables and their interpellations, the structural equation modeling (SEM) method was used. As the normality test showed that the sample does not present normal distribution (Kolmogorov-Smirnov test  $p < 0.05$ ), a partial least squares (PLS) model was used for goodness of fit (Hair, Hult, Ringle, & Sarstedt, 2014; Ringle, Silva, & Bido, 2014). For the analysis, the evaluation of the measurement model was carried out, by evaluating the convergent validity and discriminant validity of each variable before proceeding with the evaluation and interpretation of the Structural Model.

## 3. Results and discussion

First, the convergent validity of the model was evaluated using Average Variance Extracted (AVE), Composite Reliability and Cronbach’s Alpha. All the indices presented satisfactory fits (see Table 2), meaning it was possible to conduct a discriminant validity analysis of the model.

The discriminant validity of the constructs was then analyzed using the methodology of Fornell and Larcker (1981), comparing the square roots of the values of the AVEs of each construct with the (Pearson’s)

**Table 2**  
Convergent Validity of the model.

Construct	Items	Mean (Stander Deviation)	95% Confidence Interval	Median	Factor Loading	AVE: Average Variance Extracted	Composite Reliability	Cronbach's Alpha
<b>Concern towards Traceability</b>	I only choose beef when it is possible to identify its origin	5,33 (1,64)	5,22–5,44	6,00	0.826	0.649	0.880	0.820
	I try to choose food with guarantees of its origin	6,22 (1,18)	6,14–6,30	7,00	0.753			
<b>Concern towards Legality</b>	I try to choose food that can be traced back to its origin in case a problem should arise	5,66 (1,56)	5,56–5,77	6,00	0.846	0.726	0.913	0.873
	Traced food means safer food	6,03 (1,36)	5,94–6,12	7,00	0.794			
	I worry about whether producers and slaughterhouses comply with labor laws (employing workers legally, safety at work)	5,90 (1,49)	5,80–6,00	7,00	0.857			
	I worry about producers and slaughterhouses using child labor or forced labor	6,02 (1,50)	5,92–6,12	7,00	0.792			
	I worry about whether producers operate legally	6,09 (1,40)	5,99–6,18	7,00	0.875			
	I worry about whether slaughterhouses operate legally	6,22 (1,24)	6,14–6,30	7,00	0.880			
<b>Knowledge</b>	I know everything about certified meat	3,64 (1,95)	3,51–3,77	4,00	0.908	0.811	0.928	0.883
	Friends always come to me when they need a recommendation about certified meat	3,79 (2,09)	3,65–3,93	4,00	0.885			
	When it comes to certified beef, I consider myself a specialist	3,61 (2,05)	3,48–3,75	4,00	0.908			
<b>Purchase intention</b>	I would buy carbon neutral meat if it were available where I shop	5,65 (1,54)	5,55–5,75	6,00	0.878	0.725	0.913	0.873
	I would trade the beef I eat today for carbon neutral meat	5,15 (1,76)	5,03–5,26	5,00	0.854			
	I would be willing to pay more for carbon neutral meat	4,58 (1,90)	4,45–4,70	5,00	0.795			
	It is very likely that I will buy carbon neutral meat in the future	5,63 (1,55)	5,52–5,73	6,00	0.877			

correlations between the constructs (or latent variables). The square roots of the AVEs must be greater than the correlations of the constructs. Table 3 shows that all the AVE values, which are on the diagonal, are higher than the other correlations that are presented, indicating that the adjusted model has discriminant validity between the constructs.

With the convergent and discriminant analyses of the constructs finalized, the path analysis of the proposed model was conducted. It was decided that 500 repetitions would be used to verify (Student's) *t*-test. As shown in Table 4, all the cause and effect relationships were significant at 1%. Meanwhile, the moderation relationship was significant, with significance of 5%.

Therefore, based on the results presented above, all the hypotheses were supported and Purchase intention of meat presented an R<sup>2</sup> of 15%, which, according to Cohen (1998), means an moderate effect. To explain the predictive relevance of the model, the Q<sup>2</sup> value for the Purchase intention was 0.102, and it is aligned with the suggestion by Hair et al.

**Table 3**  
Discriminant validity of the model.

	Knowledge	Purchase intention	Concern towards Legality	Concern towards Traceability
<b>Knowledge</b>	0.900			
<b>Purchase intention</b>	0.168*	0.852		
<b>Concern towards Legality</b>	0.157*	0.327*	0.852	
<b>Concern towards Traceability</b>	0.299*	0.328*	0.712*	0.805

Note: Diagonals represent the square root of the average variance extracted (AVE) while the other entries represent the correlations.

\*p < 0.001.

**Table 4**  
Path analysis.

Hypothesis	Structural Relationship	Structural Coefficient	Std. Error	t-value	p-value
H1	Concern towards Traceability => Purchase Intention	0.170	0.055	3.073	0.002
H2	Concern towards Legality => Purchase Intention	0.211	0.051	4.126	<0.001
H3	Knowledge => Concern towards Traceability	0.299	0.030	10.100	<0.001
H4	Knowledge => Purchase Intention	0.112	0.036	3.081	0.002
H5	Moderation effect (COVID-19 * Concern towards Traceability) => Purchase Intention	0.119	0.058	2.038	0.041

(2014) that the Q<sup>2</sup> value of more than zero value is relevant. The effect size (f<sup>2</sup>) was 0.805 for Knowledge, 0.411 for Concern towards Traceability, 0.532 for Concern towards Legality and 0.105 for de moderation effect. According to Cohen (1998), values above 0.02, 0.15, and 0.35 can be regarded as weak, moderate, and strong, respectively.

The moderate effect of R<sup>2</sup> can be explained by the limited number of antecedents present in the proposed model. A larger effect could be found by adding other variables, such as attitude (Aertsens et al., 2011), subjective norms (Menozzi & Finardi, 2019), perceived behavioural control, perceived health risks (Biasini et al., 2021) or skepticism (Quevedo-Silva et al., 2020). For a better understanding of this phenomenon, future studies could test models that aggregate these different variables.

It was possible to observe that concern towards traceability had a

positive relationship with the purchase intention of certified beef (H1). With the concern raised over safety in beef production and its consumption, it was expected that consumers would use traceability as a quality attribute. Studies suggest that traceability can contribute to increasing consumer confidence in the entire food system, offering a quality assurance (Hobbs, 2016). Investment in brand and certification attributes are examples of ways to guarantee access to relevant information in the attempt to provide greater security and generate trust with consumers (Grunert et al., 2004; Verbeke & Ward, 2006). Thus, the certification of protein can be an attribute of choice of beef and a generating factor of greater confidence and perception of quality (Aprile, Caputo, & Nayga Jr., 2012; Pardo et al., 2015).

In addition, the importance of traceability should only increase with technological advances in the sector. A recent example is the use of smart packaging, which can monitor the internal and external changes in a product and communicate with an external interface (Vanderroost, Ragaert, Devlieghere, & De Meulenaer, 2014). This allows the exchange of quality information with consumers, enhance product's safety, and improve traceability of the product while moving across the supply chain (Chen, Brahma, Mackay, Cao, & Aliakbarian, 2020). This technological advance and others are already showing effects in consumers concern about safety and quality (Kemény & Ilie-Zudor, 2016).

The concern towards legality of slaughterhouses also showed a relationship with purchase intention (H2). Outbreaks of COVID-19 in some slaughterhouses in Brazil that led production to be halted and caused uncertainty regarding the extension of contamination between people and the possible contamination of meat may account for the effect of the concern towards legality variable being the highest in the tested model. Amid the news and uncertainties of this time, perceptions over slaughterers complying with legal standards led to safer consumption.

The level of subjective knowledge of certification was related to the importance attributed to traceability (H3) and was also directly related to purchase intention (H4). Traceability provides consumers with information on the whole production process of the product they are consuming, but this large volume of extra information can cause more doubts if consumers are unable to interpret it. Therefore, subjective knowledge, which represents consumers' perceptions of how much they believe they know about the subject, proved to be important. With higher levels of knowledge, the consumer values traceability more and has a greater intention of consuming certified beef.

Finally, the higher level of fear/concern over COVID-19 led to greater importance being attributed to traceability with regard to the purchase intention of meat (H5). As concern/fear of COVID-19 increases, traceability carries more weight with regard to purchase intention. The  $f^2$  of 0.105, representing an effect between weak and moderate, demonstrates that this effect still needs to be further studied, especially in relation to the association made by consumers between the COVID-19 pandemic, meat production and perceived health risks related to food. The pandemic led people to focus on the need for even stricter production standards that guarantee food safety (Mussell et al., 2020). The risk associated with food safety has been shown as a relevant variable for the purchase of food in stores (Rossi, Stedefeldt, Cunha, & Rosso, 2017), or online (Quevedo-Silva et al., 2016), specially in crisis situations (Pennings et al., 2002). The results showed that, at this time, attributes such as traceability and certification can help to strengthen the perception of safety.

#### 4. Conclusions

The aim of this study was to analyze the effect of the COVID-19 pandemic on the purchase intention of certified beef, proposing and testing a model relating concern towards traceability and legality and consumers' knowledge level, in addition to analyzing the moderating effect of consumers' concern/fear of the COVID-19 pandemic.

This work contributes to the literature by proposing and validating a

model for certified beef purchase intention. The study also verifies these interactions in a pandemic situation. Another contribution of the study is its analysis of the moderation of consumers' fear of COVID-19. These results show that variables related with the consumers' perceptions have significant effects even in a pandemic situation, and thereby, should be considered. In addition, the results add to the current literature related to food consumption (Song et al., 2017; Wang & Tsai, 2019), traceability and certification (Jin & Zhou, 2014; Liu et al., 2019), and subjective knowledge (Rodrigues et al., 2017).

Considering the magnitude of the COVID-19 pandemic, understanding how consumers react to the possibility of risk in the face of such a crisis can help companies to develop strategies to confront such problems. While the level of concern/fear of COVID-19 may be beyond the control of managers, the analysis of the relationships assessed in this study can serve as a basis to formulate strategies. For example, the results suggest that concern towards traceability and legality are significant for purchase intention of certified beef. Retailers can offer products that are traceable to the farm of origin and products with certifications. Beyond that, retailers and producers could conduct campaigns with the specific objective of informing the consumer and presenting evidence that the product was produced safely, following health and safety protocols and can be consumed.

The limitations of the study include the non-probabilistic data collection process, which precludes a generalization of the results. It should be highlighted that, in order to ensure validity and representativeness, the data were collected in accordance with the proportional consumption of meat all over Brazil. Even so, the sample data show a higher percentage of young consumers with a higher level of education than the population data. These characteristics can affect the research results, since education (Menozzi & Finardi, 2019), and age (Tsakiridou, Boutsouki, Zotos, & Mattas, 2008) can affect the consumption of certified foods. Notwithstanding the purpose of this research was not to carry out a representative sample of Brazil, these discrepancies could be better addressed in future studies.

Another suggestion for future research is to replicate this model over time to gauge the evolving perception of consumers as the pandemic fades into the past. It would be interesting to check whether the effect would diminish over time. Furthermore, other variables could be added to the model to gauge how these new relationships occur. Another possibility is to employ different methodologies such as experiments or in-depth qualitative research to enable a better understanding of this phenomenon.

#### Declaration of competing interest

The authors declare no conflict of interest.

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#### CRedit authorship contribution statement

**Filipe Quevedo-Silva:** Conceptualization, Methodology, Formal analysis, Writing – review & editing, Writing- Reviewing and Editing. **Thelma Lucchese-Cheung:** Conceptualization, Writing – original draft, Visualization. **Eduardo Eugênio Spers:** Conceptualization, Methodology. **Fabiana Villa Alves:** Conceptualization, Visualization, Resources. **Roberto Giolo de Almeida:** Writing – review & editing, Validation, Resources.

#### Declaration of competing interest

The authors declare that they have no known competing financial

interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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