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BEEF QUALITY ATTRIBUTES: A SYSTEMATIC REVIEW OF CONSUMER PERSPECTIVES

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ABSTRACT:

Informed by quality theory, this systematic literature review seeks to determine the relative importance of beef quality attributes from a consumer perspective, considering search, experience and credence quality attributes. While little change is anticipated in consumer ranking of search and experience attributes in the future, movement is expected in terms of ranking within the credence category and also in terms of the ranking of credence attributes overall. This highlights an opportunity for quality assurance schemes (QAS) to become more consumer focused through including a wider range of credence attributes. To capitalise on this opportunity, the meat industry should actively anticipate new relevant credence attributes and researchers need to develop new or better methods to measure them. This review attempts to identify the most relevant quality attributes in beef that may be considered in future iterations of QAS, to increase consumer satisfaction and, potentially, to increase returns to industry.

KEYWORDS: Beef; quality; search attributes; experience attributes; credence attributes; quality assurance; consumer

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1. INTRODUCTION

Consumer perspectives on meat quality are complex (Pethick, Ball, Banks & Hocquette, 2011; Verbeke, Perez-Cueto, de Barcellos, Krystallis & Grunert, 2010a; Grunert 2006; Grunert, Bredahl, & Brunso, 2004). A useful framework to understand this concept draws on the economics of information approach to user-oriented quality; this has been applied to meat by many authors (Henchion, McCarthy, Resconi & Troy, 2014; Realini, Font i Furnols, Sanudo, Montossi, Oliver & Guerrero, 2013; Grunert et al., 2004). In this approach, quality is considered in terms of the points at which a consumer can ascertain quality, and refers to search, experience and credence attributes. Search attributes are used by the consumer at the point of purchase to evaluate alternatives and make selections (Steenkamp, 1990). Quality cues used to communicate such attributes to consumers can be either intrinsic or extrinsic (Hocquette, Botreau, Picard, Jacquet, Pethick & Scollan, 2012). Intrinsic cues are the inherent characteristics of the product that cannot be altered without altering the nature of the product. They are important in determining quality expectations in many fresh food categories including meat, e.g. level of visual fat or marbling. Such cues however may sometimes serve a dysfunctional role in this regard due to consumers making inferences that lead to inappropriate quality expectations (Grunert et al., 2004). Extrinsic cues are not physically part of the product but represent information related to the product (Steenkamp, 1990), that can be modified externally, e.g. use-by-dates, information relating to origin and information relating to production and processing practices (Grunert, 2006; Grunert et al., 2011).

Experience attributes, the most important of which is eating quality, as represented primarily by flavour and texture in relation to meat, are used when actually consuming the product (Henchion et al., 2014). Based on experience at the point of consumption, quality expectations created earlier are either affirmed or refuted (Acebron and Dopico, 2000) and

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thus consumer satisfaction levels are determined. Unsurprisingly, consumers' experienced eating quality strongly influences future purchase decisions of beef (Banovic, Grunert, Barreira and Fontes, 2009). Credence quality dimensions, unlike search and experience attributes, cannot be assessed by the average consumer, even following consumption. Consumers are dependent on others to provide them with information to verify such attributes, relying on extrinsic cues as the dominant means of communication (Realini et al., 2013). Examples include animal welfare and environmental issues, i.e. they are often related to the quality of the production process as opposed to the intrinsic characteristics of the product Health is another example of a credence attribute because the relation between consumption and a beneficial consequence in health is usually a long-term effect, which is generally not assessed by a consumer (Oude Ophuis and Van Trijp, 1995). If extrinsic cues are trusted, e.g. labels, they could become search quality attributes at the point of purchase (Realini et al., 2013). While meat products in some countries are promoted as being grass fed, free range, hormone-free, antibiotic-free, etc., often there are no relevant available cues to verify credence quality attributes and so perceived quality can only be determined to a limited extent for such attributes (Grunert et al., 2004). This represents an opportunity for science and technology to contribute to quality assurance (QA) schemes.

Over the years, QA has evolved in terms of practice and focus. One obvious change in practice is the shift from physical inspection of end product to an additional concern with quality management systems and on-line process control systems (Dalen, 1996). This indicates an increased interest in credence attributes, which were identified above as being often related to the quality of the production process as opposed to the intrinsic characteristics of the product. With regard to meat, quality assurance was traditionally based on *post-mortem* inspections of carcasses and offal (Webber, Dobrenov, Lloyd & Jordan, 2012). This

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approach, largely developed in the late 19th and early 20th centuries and based on prevailing scientific knowledge regarding food safety, was concerned with detecting abnormalities that were of public health significance (such indications of parasites and diseases). However, scientific and technological advances have resulted in moves to reform the meat inspection process in many countries away from this expensive and labour intensive approach. This move is primarily driven from a public health and resource efficiency perspective, with arguments to integrate some elements of traditional inspection with information from the pre-slaughter period along with modern technology for rapid and accurate detection of hazards (Webber et al., 2012), i.e. integrated QA schemes that focus on controls on farm (usually verified by an "auditable paper trail"), and inspection in the factory at arrival, in lairage and *ante-mortem*. Such inspections encompass more than just visual inspection, including for example microbial testing following regulations on the microbiological criteria of foods. At a regulatory level, EU regulations on food safety standards are now geared toward quality control (in the process, the final product and throughout the product's shelf life), process verification, labeling and traceability (Albisu, Henchion, Leat & Blandford, 2010). Advanced scientific methods continue to be developed to support this, e.g. ambient mass spectrometry offers new possibilities for fast and accurate tests to underpin more sophisticated monitoring systems (Black, Chevalier & Elliott, 2016). Moreover, advances in areas such as proteomics and genomics which contribute significantly to understanding the molecular or biological components of meat quality offer new opportunities for providing quality assurance (Mullen, Stapleton, Corcoran, Hamill & White, 2006).

In parallel, there has been a change in focus from ensuring that certain minimum standards are adhered to from consumer protection (e.g. regarding issues of public health concern) and international trade perspectives (e.g. verifying that the product is true to description) to

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ensuring that the product also meets consumer expectations relating to eating enjoyment (organoleptic attributes) and social, moral and ethical quality aspects. In relation to meat, the main organoleptic attributes relate to eating quality and several schemes have attempted to guarantee consistent eating quality for consumers. For example, Meat and Livestock Australia (MLA) has developed the Meat Standards Australia (MSA) eating quality grading system based on Palatability Assessed at Critical Control Points (PACCP) principles. This uses a modelling approach to predict meat eating quality according to different cooking methods from recorded production and processing factors (Polkingthorne, Watson, Porter, Gee, Scott & Thompson, 1999). Adaptations to the modelling done in Australia have been undertaken in several countries including France, Poland, the USA, Korea, Japan, South Africa, New Zealand, Northern Ireland, and the Republic of Ireland based on different weightings for the experience attributes relating to tenderness, juiciness and flavour. Such weightings are based on consumer sensory tests (Hocquette, Van Wezemael, Chriki, Legrand, Verbeke, Farmer, Scollan, Polkinghorne, Rødbotten, Allen, & Pethick, 2014). Other modelling approaches have been developed by other researchers, e.g. based on muscle biochemistry (Hocquette et al., 2014).

Quality aspects incorporated into QA oftentimes underpin market differentiation objectives. These aspects can vary depending on the scheme and the market. Some issues, such as food fraud that have occurred "since trading began" (Black et al., 2016, p268), have grown in significance due to the increasingly global nature of the food supply chain. Food fraud is now estimated to affect up to 10% of all food that is eaten in the developed world and 20% in the developing world (Johnson, 2014). Traceability programmes and DNA-based tests, e.g. Identigen, have been developed for such purposes (Goldberg and Preble, 2013). Other credence type attributes (e.g. animal welfare, sustainability) are being included in QA

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schemes in response to consumer interests and concerns and government regulations. Not all such schemes are however consumer focused, for example the Origin Green programme in Ireland has been developed initially as a QA scheme targeted at industry (Henchion et al., 2014). Further evolution in QA schemes is challenging since what determines quality evolves over time in response to market and regulatory factors as well as the state-of-the-art in scientific and technological knowledge. Ultimately the value of these schemes depends on 1) the robustness of the scheme in delivering consistently on salient experience and credence attributes and 2) consumers making the connection between the relevant search attributes (normally an extrinsic cue linked to the scheme such as a label) and expected quality.

This paper is not advocating a new QA system based on attributes relating to perceived quality but seeks to highlight other factors that may be worth considering in future iterations of various beef quality assurance schemes. This could help to make QAS more consumer-focused in the future. It does so by providing insights obtained from identifying the relative importance that consumers place on different search, experience and credence attributes, utilising a systematic review.

2. METHODOLOGY

Many studies have been conducted around the world to examine consumer perspectives on meat quality. Several recent research projects and subsequent articles and reviews, such as Grunert, Verbeke, Kugler, Saeed, and Scholderer (2011); Pethick et al., (2011); and Verbeke et al., (2010a) have been published in the area. A systematic review provides an opportunity to identify all of these studies and to collate and synthesise the

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findings so as to provide a holistic view on the meat quality attributes of importance to consumers.

The systematic review undertaken for this paper followed the five steps described in Khan, Kunz, Kleijnen and Antes (2003), i.e. 1) framing the question; 2) identifying relevant publications; 3) assessing study quality; 4) summarising the evidence; and 5) interpreting the findings.

2.1 Framing the question

The question posed in undertaking the review was: what indicators are used by consumers to determine beef quality and what is the relative importance of each? Beef is defined as retail cuts of beef available for sale to the final consumer and excludes meat products, processed meat and meat-based meals or meal components. No geographical constraint was set for the location of consumers. However, as the systematic review was conducted using publications printed in English this has an inevitable effect on the geographic profile of included studies and led to a focus on developed economies.

2.2 Identifying relevant publication

The time frame of the search was from January 2000 to September 2013. The key words used to search the fields of title, and/or abstract and/or key words are outlined in Table 1. The searches were conducted in the database platforms *ISI Web of Knowledge* and *ProQuest* (FSTA® and CAB ABSTRACTS databases).

Insert Table 1

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Records from the databases (3,498) were exported directly to EndNote and duplicates were removed. A first screening, based on reviewing the title and/or abstract, removed out-of-topic records, articles written in different languages and further duplicates. The review was confined to published journal articles as such research has been peer-assessed, thus acting as an important marker on the quality of the data and results presented. Additionally, journal articles are readily accessible through electronic databases and relevant published information available in other sources is usually referenced; thus significant contributions from such other sources may be included indirectly through consideration of published journal articles (Klaus, 2007). A total of 379 records remained after this pre-screening process (Figure 1).

Insert Figure 1

2.3 Assessing study quality

After the first screening, the records were classified as reviews or articles. The reviews were used to identify attributes of importance whilst the articles were used to provide the relative ranking to attributes. Reviews (61 records) were assessed first by reading the title and abstract then they were further classified according to whether they considered only one quality attribute in detail or several attributes simultaneously. Once the reviews were identified and separated, the full texts were analysed in order to determine relevance and quality. Quality was assessed according the key sources used, the clarity and comprehensive exposition of their argument and the novelty. Finally, 9 reviews dealing with several attributes were selected.

Similar treatment was given to the research articles (318 records), classifying them according to whether they addressed one/few attributes or several attributes. Those that only dealt with

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1-2 attributes were excluded on the basis that it was not possible to rank using such a number of attributes. Quality was assessed in the same manner as the reviews and additionally on the quality of the methodology used (design and execution of the study). A further quality control step involved considering the impact factor of the journal. The impact factor came from the Journal of Citations Report (JCR). When journals were not listed, their H index SJR and the number of citations of the article in Google Scholar was obtained. Articles from journals not listed in the JCR, with an H index of less than 20 and less than 3 citations in Google Scholar (consulted the 11/2/2014), were automatically excluded.

2.4 Ranking

Thirty three papers were initially identified as providing some information on the relative importance of different quality attributes from a consumer perspective. However for methodical reasons, e.g. the methodology was not specified or described, attributes were not ranked individually, 15 papers remained on which to quantifiably determine the relative ranking of identified attributes.

Classification of attributes according to search, experience and credence attributes provided 22 different quality attributes for ranking. A small number of attributes that related to specific beef cuts and were not relevant to all beef products (e.g. presence/absence of bone, size/weight of cut) were not included in the ranking exercise. Some attributes were easy to classify, e.g. intrinsic attributes such as meat colour were categorised as search attributes. Organoleptic-related attributes were generally classified as experience attributes with the exception of visual cues that could be used for search. However, other attributes were more difficult to classify as they were considered in different ways by different authors. Credence attributes in particular were problematic in this regard. In such instances, classification was based on examining the way the attribute was presented in the associated paper, reviewing

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related literature and discussion within the project team. For example, origin was classified as a credence attribute when the paper presented it as concerning consumers' belief that the beef was of a particular origin, however it was treated as a search term and included under "certificates, labels, brands, information" when it was being used to aid decision making at the point of purchase. Organic beef was treated in a similar manner, i.e. where the paper was concerned with organic production as a credence attribute whereby consumers had to trust that a particular process had been adhered to, it was classified as a credence attribute. However, where the paper framed organic beef as being concerned with certified organic beef that had a label which was used at the point of purchase to influence decision making it was categorised as a search attribute. Other authors' framing of attributes had to be carefully considered in the case of some experience attributes also. For example, shelf life was not framed in the papers reviewed in terms of "expiration date" which would render it a search term; rather it was linked with wholesomeness following Grunert et al. (2004) and associated with the consumption experience.

Some credence attributes resonate with consumers based on a belief about the process (e.g. animal welfare may be of interest to an individual consumer as they are concerned with believing that animals were reared according to animal-friendly practices), whereas the same attribute can also be relevant to the consumers based on a belief in the benefit that a particular attribute will confer on the individual (e.g. animal welfare friendly beef will be better for one's health, Miranda-de la Lama et al. 2017). It is not possible to evaluate which aspect individual consumers were concerned with without referring back to them. Where it was not clear, belief about the process was assumed rather than the higher order belief in the benefit to the individual. This is in keeping with findings from Grunert et al. (2011) that beef

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products from pasture-raised cattle were evaluated more positively when no particular benefit was mentioned.

As different numbers of attributes were examined across papers, the importance of individual attributes within each study was rescaled as follows:

1) establishment of the ranking of attributes within articles, from 1 for the least important attribute to the maximum level given in the article;

2) rescaling the previous ranking from 1 (least important attribute within the article) to 3 (more important attribute within the article) according to:

re-scaled ranking (RR) = 1 + [(3 - 1) / (max level - 1)] * (given level - 1);

It should be noted that the number of levels is not necessarily the same as the number of attributes if some attributes had the same score.

3) applying an arbitrary factor according to the number of attributes considered within the paper, in order to give a stronger weight to the attributes that came from papers that considered more attributes; a factor of 1 was given for the minimum 2 attributes and 3 to the maximum number of 16 attributes that was presented across all papers, by applying the following formula:

Number of attributes factor (NAF) = [1 + (3-1 / max number of attributes-2) * (number of attributes - 2)].

4) Final score (FS) of each attribute within a paper = RR * NAF

5) The final score (FS) for individual attributes was summed across all papers.

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3. RESULTS

The details of the reviews, which are provided in the supplementary tables, provide initial information on the importance of quality attributes as well as other useful information to help to understand the consumer evaluation processes. They also provided the framework for the ranking exercise by ensuring that all relevant attributes were identified for ranking across search, experience and credence attributes

Key points related to the consumer perspectives on beef quality resulting from the reviews include:

- Sensory attributes (appearance, eating quality, consistency), health, safety, convenience, animal production and process characteristics, origin, label information, place of purchase and value for money are important quality attributes (Verbeke et al., 2010a and Verbeke, Wezemael, de Barcellos, Kügler, Hocquette, Ueland & Grunert, 2010b; Purcell and Lusk, 2003; Pethick et al., 2011; Egan, Ferguson & Thompson, 2001; Grunert et al., 2011; Grunert, 2006; Grunert et al., 2004; Grunert, 2002; Dransfield, 2005).
- Inference of some attributes are based on others (i.e., meat colour for tenderness, organic production for taste), which sometimes generates uncertainty (Verbeke et al., 2010a; Grunert, 2006; Dransfield, 2005; Grunert et al., 2004; Grunert, 2002).
- The relative importance of attributes varies according to stage in the decision and consumption processes (e.g. before tasting vs after tasting, pre-purchase vs at consumption), but in re-purchase situations attributes may change due to previous

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experiences (Dranfield, 2005; Grunert et al., 2004; Purcell and Lusk, 2003; Egan et al., 2001).

- What citizens think is not always reflected in what consumers do (Grunert 2006; Purcell and Lusk, 2003)
- Credence attributes and extrinsic cues are becoming more important than intrinsic characteristics in general (Verbeke et al., 2010a; Grunert, 2006), but concerns vary by individual with consumers' knowledge/experience having an impact (Grunert et al., 2004; Dranfield, 2005; Verbeke et al., 2010a). A change in purchasing behaviour from fresh beef purchased at a butcher's counter to packaged beef presented on a supermarket shelf is also influential (Grunert, 2006).
- Health is more important than safety nowadays, but this could change in a crisis situation (Verbeke et al., 2010a; Grunert, 2002).
- Intrinsic quality requirements are similar worldwide, although the ranking of importance may change over time and between countries (Egan et al., 2001; Dransfield, 2005; Verbeke et al., 2010a).

Table 2 presents the overall ranking of quality attributes identified from the eligible research papers, the relative ranking of attributes under each of the headings of search, experience and credence attributes and the number of papers that were used to determine the ranking for each attribute. It presents results on 22 different types of quality attributes; 7 search, 5 experience and 10 credence attributes.

Price and "certificates, labels, brands, information" and visible fat were ranked as the three most important search attributes. Flavour, "freshness/wholesomeness/shelf life and tenderness are all important experience attributes and are ranked in this order. Origin, animal

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welfare, and production system/feeding are the three most important credence attributes. Environmental issues are relatively unimportant. The top 10 ranked attributes span all three quality dimensions. In particular the mix of experience and credence attributes highlight the variety of expectations consumers hold for beef.

Insert Table 2

While it is acknowledged that attributes are presented at different levels of abstraction, e.g. health is at a higher level of abstraction to breed, which could account for some differences in attention, the varying level of attention is noteworthy as it begs the question as to how researchers make decisions on which attributes to study. Further consumer research resulting in hierarchical value maps, based on Means End Chain (MEC) modelling for example could provide insight into consumers' motivational cognitive structure (Sorenson and Henchion, 2011) and provide a framework for organising attributes according to different levels of abstraction.

4. DISCUSSION AND CONCLUSIONS

The results show that research on consumers' attitudes towards meat quality encompassed a large number of attributes (ranking was performed on 22 attributes), which span search, experience and credence domains. Amongst the search attributes, the top two are extrinsic attributes (price and certif., labels, brands, information) whilst the next three are intrinsic attributes (visible fat, meat colour, appearance). The fact that price is the most important search attribute, the second most important attribute in terms of relative rankings, and also is the most considered attribute from a research perspective (as measured by number of papers)

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underlines the influence of economic factors and reinforces a view that price may be considered the "ultimate attribute". It represents the financial trade that consumers must make to experience promised product benefits while also supporting consumers in making inferences on experience and credence attributes. Among the intrinsic attributes, visible fat (which includes external and intramuscular fat or marbling) and colour were the most important. External fat can be readily changed since the whole supply chain can contribute to it (Pethick et al., 2011); however marbling is more complex so that market segmentation for health conscious and sensory driven consumers might be the required to achieve consumer satisfaction (Killinger et al., 2004). Meat colour is traditionally an important cue and is used by consumers to infer freshness, taste and texture (Font i Furnols and Guerrero, 2014), however the relationship between colour and eating acceptability is not always as expected (Carpenter et al., 2001). The use of more extrinsic cues to convey these attributes as a complement to colour could be worth exploring to increase consumer satisfaction.

The experience attributes identified and ranked are rather in line with what would be expected; flavour, freshness/wholesomeness/shelf and tenderness were used as the main assessment criteria. Tenderness is usually considered the prevalent eating quality aspect, particularly in beef and explains why tenderloin (*psoas major*) is the most expensive cut in several countries (Koohmaraie & Geesink, 2006). Previous successful efforts of some meat supply chains to improve tenderness may explain why flavour is seen as more important and therefore, an increased focus by industry on beef flavour may be warranted in the future However, addressing flavour is a more challenging task since flavour is more complex to measure objectively (both instrumentally and sensorially). Furthermore it is likely to be more difficult to achieve agreement amongst consumers in terms of their preferred flavour profiles and intensity.

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Origin is the most highly ranked credence attribute; it also received a lot of attention from researchers. In the past fresh meat was mainly unbranded and purchased in butcher shops however changes in meat purchasing patterns and associated increases in packaging, as well as mandatory country of origin labelling in many regions, heightens the importance of extrinsic cues such as origin (Grunert, 2006). The importance of origin reflects a preference for domestically produced beef in most instances including the EU, USA and Japan (Realini et al., 2013, Yong et al., 2010 and Egan et al., 2001). Domestically produced beef, or beef produced in nearby countries, is associated with safety in such regions (Verbeke et al., 2010a) which resonates with view that consumers' attitudes toward a nation are based on perceived competence (Fiske et al., 2007), i.e. have a cognitive dimension. However such attitudes are also believed to be based on "perceived warmth" of the country, such that country of origin has a symbolic and emotional meaning for consumers (Hersleth, Næs, Rødbotten & Monteleone, 2012) and is tied to the values of locality and authenticity (Shimp & Sharma, 1987).

The wide range of credence attributes presented is interesting and reflects the complexity inherent in consumer inference making around beef. The first important observation is that credence spans trusting in what is said about the product to trusting what this 'will do' for the consumer (e.g. origin versus health). Indeed consumers need to trust that certain characteristics form part of the product if they are to trust that the health and other psychosocial benefits important to them are delivered on, e.g. consumers need to trust that animals have been fed in a particular way to confer health benefits to themselves. This is fundamental to motive fulfilment. When considering what the product 'will do' for the consumer two attributes, health and safety, are particularly noteworthy. Visible fat, which has

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been linked to both positive expectations on taste and negative expectations on health benefits, is ranked in the top 4 attributes while healthiness is ranked 11th overall. This may speak to fat embodying a notion of healthiness for the product. The same could be said for label information (ranked 3rd) and safety (ranked 14th). If consumers are satisfied with the information provided on the label, they may reduce considerations related to food safety, i.e. take food safety as a "given". In the case of health an alternative argument is that health is not the main priority in deliberations on whether or not to consume beef but has somewhat of a role in choosing between beef alternatives. Consumers seek some fat to provide eating enjoyment but may wish to minimise the amount consumed for health reasons. The health dimensions of beef, from a consumer perspective, are further complicated due to both benefits and risks associated with the product. While concern is expressed with regard to the consumption of saturated fats, iron and essential nutrients necessary for good health are also linked to the consumption of beef. This can create a tension or conflict in the minds of consumers in that beef may be perceived as healthy and not healthy at the same time. It should be noted that perspectives on the impact of saturated fat of animal origin, on health are changing (see Barendse, 2014) which could impact on future interpretation of fat related cues. Furthermore, the recent World Health Organisation report[1] about other health impacts of meat consumption highlights the need to continue to monitor trends in the discussion.

As more insights into the nutritional profiles of beef from differing production systems and breeds emerge the role of extrinsic cues, such as labels associated with quality assurance schemes, to convey credence attributes which promise to deliver health benefits will likely become even more significant. Equally the strategies employed that support consumer interpretation of any new extrinsic cues need to be such that they create a sustainable

[1] https://www.iarc.fr/en/media-centre/pr/2015/pdfs/pr240_E.pdf

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competitive advantage. This advantage may be delivered at a country level (e.g. grass-based beef from a particular country may result in a competitive advantage if the country has a particular advantage in producing beef from grass) or at individual company level (e.g. beef high in a particular nutrient may result in a competitive advantage for a particular company if they develop a proprietary production protocol which is protected). While the relative importance of "health, nutrition and body weight" is low, health is now an important motivator across most categories and as consumers' awareness of the relationships between diet and health increases further the health dimensions of beef cannot be ignored if beef processors are to compete effectively within the product category and with substitutes.

In relation to beef much research attention has been given to lipids and its fatty acid profile (Scollan, Hoquette, Nuernberg, Dannenberger, Richardson & Moloney, 2006), including understanding the impact of fatty acid composition on meat quality (e.g. colour, shelf life and sensory attributes) (Wood, Enser, Fisher, Nute, Sheard, Richardson, Hughes. & Whittington, 2008; Scollan et al., 2006), the effect of different animal production factors such as nutrition and genetics on fatty acid composition (Raes, Fievez, Chow, Ansorena, Demeyer & De Smet, 2004) and the human health impact of consuming beef with different fatty acid profiles (Scollan et al., 2006). Notwithstanding the need to adhere to WHO guidelines in relation to fat in the diet, scientific evidence regarding beef being an important source of fatty acids that are beneficial to human health may offer a platform for the promotion of nutrition and health related credence attributes. Indeed Grunert et al., (2004) argue that a focus on fat content and composition, combined with high eating quality is preferable for meat companies to introducing functional products. Others suggest a differentiation, highlighting the health benefit in relation to the iron, zinc and selenium content of beef (Pethick et al., 2011; Grunert et al, 2011, Egan at al., 2001; De Smet and Vossen, 2016).

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The results presented here, relating to research published between January 2000 and September 2013, are static. Whilst little change is anticipated in the ranking of search and experience attributes, movement is expected in terms of the relative ranking within the credence attribute category and also in terms of the relative ranking of credence attributes overall. The health dimensions of beef have been discussed above however another example is the expected evolution in concern with ethical and sustainable aspects of meat consumption (Henchion, De Backer & Hudders, 2016). In relation to animal welfare, Miele and Evans (2010) argue that concerns for animal welfare and the ethical aspects of meat consumption are not new but that the number of people concerned about animal welfare is increasing and that the nature of the concern has changed over time with a greater concern for the lives of animals and the risks associated with intensive systems of meat production compared to former times when the concern related to the death and associated cruelty practiced on the animal. The extent to which concern with ethical and sustainable aspects of meat production will result in differentiation opportunities is not clear, as some issues will have to be dealt with from a regulatory rather than market perspective (Henchion et al., 2014).

Notwithstanding the large number of attributes considered in the ranking exercise, research indicates that consumers use only a small number of characteristics when making quality judgements (Ngapo, Martin & Dransfield, 2005; Dransfield, 2005) and that expressed demand for information does not necessarily mean that it will be used (Grunert, 2006). Furthermore research indicates a "discord between expected and experienced quality due to misconception of certain intrinsic cues" (Henchion et al., 2014, p564) and several authors point to a lack of extrinsic cues upon which to support quality evaluations (Grunert, 2006; Bernués, Olaizola and Corcoran, 2003). Verbeke et al., (2010a) suggest that future market

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opportunities are likely to be based on extrinsic and credence attributes. Communication is critical with regards to credence attributes as quality perception becomes a question of communication (Grunert, 2002). Combining these points with the finding above on the importance of "**certif**., labels, brands, information" (extrinsic credence attributes that may function as search attributes) provides clear evidence of the need for QA schemes which address a limited number of characteristics of relevance to consumers and ensure that expected quality is in line with experienced quality. Quality labels associated with such schemes may then substitute for dysfunctional and/or traditional intrinsic cues (Henchion et al., 2014) relating to meat quality while also addressing more subjective and difficult to communicate but important credence attributes. This would help to create better alignment between expected and experienced quality. Given the likely change in the importance of credence attributes over time, industry needs to continue to monitor the macro-environment to anticipate new credence attributes of relevance to the meat sector and to consider how such new credence attributes may impact search and experience attributes/credence quality. Researchers need to consider how and what new credence attributes should be measured and in particular the interplay between new and existing salient attributes in the ultimate determination of quality. Consumer willingness to pay for the costs associated with such a scheme however will depend on the system effectively delivering what was promised (Verbeke et al., 2010b).

The significance of the broader environment (socio-cultural, economic, technological and political) in determining the direction of consumer preferences cannot be underestimated as it is this that shapes consumers and citizens' interpretation of products and processes. Thus on-going monitoring and assessment of this ever changing environment is essential.

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Figure 1 Search results (diagram based on van der Kruk, Kortekaas, Lucas & Jager-Wittenaar., 2013).

Figure 1

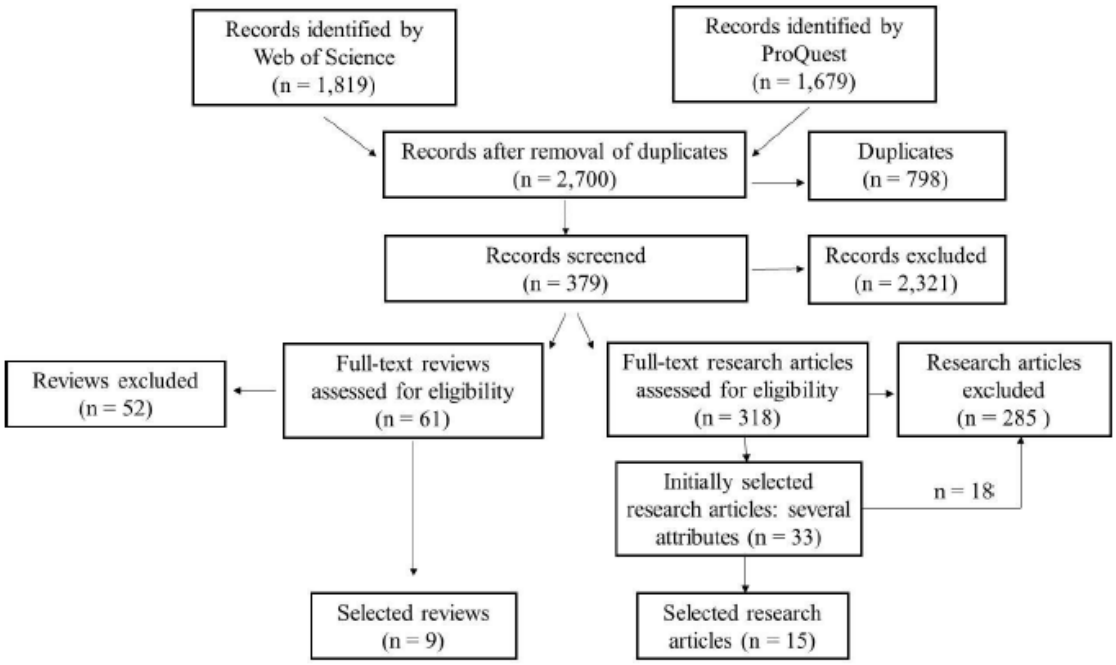

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Table 1: Literature Search: search terms and connecting words

	Quality parameters	AND
1		quality AND consumer* AND meat”
2	“attitude* OR preference* OR perception* OR behaviour	consumer* AND beef”
3	“quality attribute* OR quality cue*	beef”
4	“expect* OR experience*	consumer* AND beef”
5	“search OR credence OR experience*	consumer* AND beef”

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Table: 2: Ranking of Search, Experience and Credence Quality Attributes, including information on data sources

		Total ranking	Relative ranking (n=15)	No of papers (n=15)
Search attributes	Price	2	1	11
	Certif., labels, brands, information	3	2	8
	Visible fat	4	3	7
	Meat colour	12	4	4
	Appearance	16	5	2
	Place of purchase	19	6	2
	Packaging	20	7	3
Experience attributes	Flavour	5	1	6
	Freshness/wholesomeness/shelf life	8	2	4
	Tenderness	10	3	4
	Convenience	13	4	5
	Juiciness	17	5	3
Credence attributes	Origin	1	1	11
	Animal welfare	6	2	6
	Production system/feeding	7	3	6
	Natural (GM feed, hormones)/Organic	9	4	5
	Health, nutrition, body weight	11	5	4
	Safety (residues, health risk, etc.)	14	6	2
	Environmental issues	15	7	4
	Traceability	17	8	4
	Processing technologies (ageing, irradiation, halal/kosher)	18	9	3
	Breed	21	10	3

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