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Beef acceptability and consumer expectations associated with production systems and marbling

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ABSTRACT

Beef acceptability and consumer expectations generated with production systems and beef marbling were evaluated in two major Chilean cities. A panel of 204 consumers from Osorno and Santiago rated beef acceptability from four treatments (low or high marbling × grazing or feedlot) in a blind condition, and then with information about marbling and production systems. In addition, consumer expectations induced by the information were evaluated. Three groups of consumers, 'lean beef lovers' (25.5%), 'high expectation consumers' (53.4%) and 'grass-fed beef lovers' (21.1%), were identified based on their expected acceptability. Information about the marbling level and production systems generated positive expectations and increased acceptability of beef with low marbling levels and beef from grazing animals. Results from this study have important implications for the development of beef marketing strategies in the Chilean market.

1. Introduction

Food perception and selection is a multifactor process where our five senses, physiological and psychological aspects, and extrinsic factors participate. All these factors may influence consumer preferences and lead to the acceptance or rejection of a food (Stafleu, Graaf, Staveren, & Schroots, 1991/2). Expectations appear frequently in people's daily lives, affecting their purchasing attitudes about a food product. Expectation can be created by advertising, talking to friends, previous experiences, peers or family, etc. In this context, expectation can improve or degrade the perception of a product, even before it is tasted (Deliza & MacFie, 1996).

Numerous studies have been conducted looking at the effect of information on food expectation using different models to understand consumer expectations (Caporale, Policastro, Carlucci, & Monteleone, 2006; Cardello & Sawyer, 1992; Deliza, MacFie, Feria-Morales, & Hedderely, 2000; Hersleth, Lengard, Verbeke, Guerrero, & Næs, 2011; Lange, Rousseau, & Issanchou, 1999; Meillon, Urbano, Guillot, & Schlich, 2010; Siret & Issanchou, 2000).

In the classic approach three consecutive steps are evaluated: blind, expected and informed acceptability. A disparity between expected and blind acceptabilities is defined as disconfirmation which could be either positive (the blind acceptability is higher than expected) or negative (the product is worse than expected). Assimilation model occurs when product evaluation changes in the direction of expectation whereas the contrast model occurs when product evaluation changes in the opposite direction of expectation, thus increasing the discrepancy between product evaluation and expectation. Furthermore, in the case of assimilation, when the difference between expected and informed score is significantly different from zero, it means that consumers do not completely assimilate towards their expectations (Siret & Issanchou, 2000). Incomplete assimilation can lead to a decrease in future consumer expectation as a result of repeated disconfirmation (Deliza & MacFie, 1996; Lange et al., 1999). Sensory properties that can affect the informed acceptability, play an important role in the incomplete assimilation (Napolitano, Caporale, Carlucci, & Monteleone, 2007).

Visual impressions based on perceived intrinsic and extrinsic cues, such as label information and appearance of a product, are important inputs that may generate beef quality expectations (Bello Acebrón & Calvo Dopico, 2000). Thus, the information about production systems and beef marbling can modify expectations about beef, influencing consumer-purchasing decisions. Bello Acebrón and Calvo Dopico (2000) indicated that meat quality traits such as colour, freshness and marbling of beef can influence consumer-purchasing decisions. For instance, Grunert (1997) and Bello Acebrón and Calvo Dopico (2000) found that light meat colour is preferred over dark meat, whereas Steenkamp and Van Trijp (1996) found a positive evaluation when redness increases. Beef expectation increases with an attractive appearance and freshness and decreases with the amount of visible fat (Bello Acebrón & Calvo Dopico, 2000). According to Issanchou (1996), consumers

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use visible fat (external and internal) as a health indicator at the point of purchase. On other hand, it has been shown that beef marbling is an important positive expectation generator in several markets because there are consumers who relate marbling with eating quality (Egan, Ferguson, & Thompson, 2001). Conversely, in Chile and some European markets, consumers tend to reject beef with high levels of marbling (Grunert, 1997; Schnettler et al., 2010). However, consumer sensory studies of the effect of marbling on beef acceptability have not been carried out in Chile.

Recent studies have been conducted focused on the effect of animal welfare information on beef (Napolitano & Caporale et al., 2007a) and lamb expectations (Napolitano, Braghieri, Caroprese, Marino, Girolami, & Sevi et al., 2007), while Other studies have related origin (Cerjak, Karolyi, & Kovacic, 2011) and production system (organic vs conventional) to meat expectation (Napolitano et al., 2010).

There are different beef production systems in Chile according to the finishing diet. In the central part of Chile (32–38°S), animals are fed in feedlots using rations produced in the farms, such as corn silage, alfalfa hay and soiling of oats (Claro & González, 2005). Grain usually represents between 20% and 40% of the total diet in Chilean feedlots. In contrast, beef production in the southern regions of Chile (38°–41°S) relies on direct grazing, where there is a temperate rainy climate and pasture is the main feeding source. Livestock production is important in the southern regions of the country, representing more than 50% and 70% of national beef and milk production, respectively (INE., 2007). The dairy industry is an important source of animals for beef production because only 20% of the animals produced in Chile come from beef cattle breeds, whereas the rest come from dairy systems (Goic, 2001). The Chilean beef production were 190,979 ton of carcass in 2011 and 54.8% were from steers under 36 months (Echávarri, López, Amunátegui, & de la Fuente, 2012). A recent study evaluated the nutritional quality (intramuscular fat and cholesterol content and fatty acid composition) of beef produced in Chile under different production systems classified according to the type of finishing diet (Morales, Folch, Iraira, Teuber, & Realini, 2012). However, no information about the consumer sensory preferences for Chilean beef from different finishing systems is available. In general, consumer responses in surveys indicate a preference for beef produced on pastures (Schnettler, Ruiz, Sepúlveda, & Sepúlveda, 2008). However, in many acceptability studies, consumers tend to prefer the type of beef produced locally to the beef produced in other systems (Realini et al., 2009; Sitz, Calkins, Feuz, Umberger, & Eskridge, 2005).

The aim of the present study was to evaluate the effect of production systems and marbling of beef on consumer acceptability and expectations in two major Chilean cities: Osorno and Santiago.

2. Materials and methods

2.1. Beef selection and sample preparation

Beef was obtained from Holstein–Friesian steers slaughtered between 485–550 kg liveweight. Thirty-two left *Longissimus thoracis* (LT) muscles were selected from a batch of 64 commercial loins according to production systems and marbling levels. Half of the LT muscles were obtained from animals finished on pasture only (last 120 days), whereas the other half were collected from steers finished on feedlots (pasture silage: 1.8% Dry Matter (DM) of Live Weight (LW) and wheat or oats 1.0% DM of LW). *Longissimus thoracis* muscles from each feeding group were classified into low and high marbling levels according to the Meat Standards Australia (MSA) (Anonymous, 2005). Marbling was evaluated by Slaughterhouse staff at the 10/11th rib level of each loin in the slaughter house. Samples of 200 MSA marbling score were classified as Low Marbling, whereas loins of 400 MSA marbling score were classified as High Marbling. A total of four treatments (PL: pasture/low marbling, PH: pasture/high marbling, FL: feedlot/low marbling, FH: feedlot/high marbling) and 32 loins from eight animals per treatment were evaluated. Loins were vacuum packaged, transported to the meat laboratory of INIA-Remehue, Chile and kept frozen at −18 °C ± 2 °C until analyses. *Longissimus thoracis* muscles were thawed at 4 °C ± 2 °C over 24 h and cut into 12 steaks of 2.54 cm thickness. Six steaks were used for physicochemical and sensory analysis and the other six were used for consumer testing.

2.2. Sensory analysis by trained panel

An eleven-member trained panel participated in the sensory analysis. The training and testing sessions were conducted at the Sensory laboratory of the "Instituto de Investigaciones Agropecuarias (INIA) Remehue" Center (Osorno, Chile). The panellists were selected from a group of 30 persons without previous experience in sensory evaluation. The assessors were selected and trained following ASTM (ASTM, 1981) and ISO standards. Sensory attribute definitions of beef were discussed in early sessions. The panellists completed 48 h of training sessions on the evaluation of the selected beef attributes (Table 1). The sensory definition and reference for each attribute is shown in Table 1. The sensory laboratory was designed according to ISO standards with separate booths, and the samples were evaluated in a sequence established to avoid the effect of sample order presentation, first-order or carry-over effects (MacFie, Bratchell, Greenhoff, & Vallis, 1989). The panel performance was evaluated by ANOVA evaluating the

Table 1
Sensory attribute definition, references and results of panel performance.

Sensory attribute	Definition	Reference for point 0	Reference for point 10	*F*-value			Error mean square
				Panellist	Sample	Panellist × Sample	
Red colour intensity	Intensity of red colour in raw beef steak	L^*: 54.4 ± 1.06 a^*: 25.8 ± 1.10 b^*: 14.9 ± 1.17	L^*: 31.2 ± 0.79 a^*: 19.4 ± 2.76 b^*: 8.26 ± 1.63	1.902	2.216	1.038	2.033
Marbling	Level of strips of fat within the lean sections of beef steak	0 MSA marbling	8 MSA marbling	3.930	25.022	2.601	1.067
Juiciness	Overall impression of juice perceived in the mouth during chewing	Striploin cooked at 80 °C	Striploin cooked at 60 °C	1.336	0.634	1.655	3.305
Tenderness	The force necessary to chew the beef sample	Muscle cook at 71 °C	Tender loin cooked at 71 °C	3.318	0.231	1.006	3.485
Flavour	Intensity of flavour characteristic of beef	Veal beef at 71 °C	Outside cooked at 71 °C	2.059	2.775	2.305	2.081

L^*: lightness; 0: black, 100: white.
a^*: redness/greenness; positive values: red, negative values: green.
b^*: yellowness/blueness; positive values: yellow, negative values: blue.