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Influence of various traditional seasonings on beef flavor: United States, Spanish, and Argentinian practices

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ABSTRACT

A consumer study was conducted to determine the most popular beef seasonings used in three countries: Argentina, United States (US), and Spain. Once the typical cooking methods and seasonings in these countries were established, descriptive analysis was used to determine the differences in the main flavor attributes, particularly the impact on beef characteristics, of the samples. Large variations were found in the consumer practices in the studied countries, and the preferred seasonings from each country were identified. This study showed that on average US consumers would prefer beef products with more initial flavor impact, brown/roasted and salty characteristics than Argentinian or Spanish consumers. The addition of seasonings changed some of the main beef attributes, but the changes were dependent on the cooking method. Beef identity (Beef ID), brown/roasted, and bloody/serumy were the attributes most affected when adding different seasonings.

1. Introduction

The world production of beef is led by the US, with an estimated production for 2012 of 11,469,000 million tons carcass weight equivalent (MT CWE), with EU-27, including Spain, and Argentina occupying the third and sixth position, with productions of 7,995,000 and 2,600,000 MT CWE (IndexMundi, 2012). However, the relative positions of these three countries change when the per capita consumption is considered, with Argentina, US and EU-27 occupying the second (55 kg person^{-1}year^{-1}), fifth (36 kg person^{-1} year^{-1}) and twenty-fourth (15 kg person^{-1} year^{-1}) positions world-wide. Therefore, Argentina and the US can be taken as model countries with both high production and consumption of beef, while Spain can be considered as a model country following a Mediterranean diet.

Most current research on beef sensory attributes is related to texture properties, but flavor has been reported as an important factor which drives consumer overall preference for beef steaks (Lorenzen, Davuluri, Adhikari, & Grün, 2005).

Adhikari et al. (2011) and Maughan, Tansawat, Cornforth, Ward, and Martini (2012) developed lexicons for beef flavor in which various samples, including different muscles, quality grades, and feeding regimes, were studied. The lexicon by Maughan et al. (2012) included 18 generally defined attributes and the lexicon by Adhikari et al. (2011) had 12 specifically defined main attributes present in almost all samples, and some other attributes present only in specific samples. Until those studies, most research studies using sensory properties of beef products used main flavor descriptors ("beef flavor", "beef aroma", "off flavor", etc.), or were related with specific beef types. Examples of this situation are: (1) the lexicon developed by Johnson and Civille (1986) was for warm-over descriptors in meats; (2) attributes related with different fed regimes in beef were reported by Miller, Rockwell, Lunt, and Carstens (1996), and (3) flavor descriptors related with irradiated beef were reported by Luchsinger et al. (1997).

Although beef flavor has been widely considered in numerous studies, and the addition of seasonings to beef is common among consumers, the influence of different seasonings on beef flavor has not been widely studied. Adding 0.5% garlic or onion before the irradiation of beef has been reported to have a protective effect from lipid oxidation, but provides some garlic/onion aromas to the resulting product (Yang, Lee, Moon, Paik, & Ahn, 2011). The addition of some garlic compounds (diallyl sulfide, diallyl disulfide, *s*-ethyl cysteine, and *n*-ethyl cysteine) enhanced color, minimized lipid oxidation, and improved microbial safety in ground beef, but no sensory analyses were done in the study (Yin & Cheng, 2003). The use of 0.1% rosemary extract in minced beef enhanced the oxidative stability of lipids during simulated retail storage, minimized the warmed over flavor notes, and maximized consumer acceptability when compared with samples containing other added antioxidants (McBride, Hogan, & Kerry, 2007). Also, cinnamon, clove, fennel, star anise, and pepper were studied as possible natural antioxidants by Dwivedi, Vasavada, and Cornforth (2006). These authors reported that clove (0.1%) and the other spices (0.5%) in cooked ground beef had effective antioxidant effects if compared to a control without seasonings. At the same time, the spices reduced rancid odor and flavor, and imparted

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different spicy notes to the samples, e.g. licorice and spicy flavor from adding fennel or star anise and peppery and hot from adding pepper. All these studies reported the positive influence of some seasonings on the beef products but none of them studied the main flavor notes of the beef.

In addition to all these technological properties, it has already been demonstrated that some seasoning extracts, such as sage or oregano extracts added to beef patties, have "bioactivity" after cooking and digestion (antioxidant potential), and can be used as functional ingredients (Ryan et al., 2009). Oregano and sage are two of the many possible seasonings to study, but until now there has been little information about which herbs or seasonings are preferred and most used by consumers in preparing beef products.

The two main objectives of this study were: a) to obtain information about beef consumers' culinary practices, and flavor characteristics that consumers consider familiar in their beef products and b) to determine if adding different seasonings to beef significantly changes its basic flavor characteristics, or if these seasonings simply add new flavor notes. Three locations, each in a different country, (Argentina, United States (US), and Spain), were studied to represent different consumer models.

2. Materials and methods

2.1. Consumer study

A consumer study was conducted to determine the main customs of beef consumption in three different locations: Alicante in southeastern Spain, Nueve de Julio in the Buenos Aires province of Argentina, and Manhattan in the state of Kansas USA. The questionnaire was completed by consumers who cook the beef they consume. Countries were chosen due to their different frequencies in beef consumption: Spain represented "low consumption", the US represented "medium consumption", and Argentina represented "high consumption" of beef. One limitation of the study is that the survey was conducted in only one area/region of each country. Therefore, the surveys' results are related with each region and may not be representative of the whole country due to possible regional differences. Ninety nine, 100, and 121 consumers participated in this study in Argentina, USA, and Spain, respectively.

The survey included questions in which consumers indicated: (1) which cooking methods do they usually use, (2) how often do they consume beef, (3) in which situations do they consume beef (at home, in restaurants, etc.), and (4) which seasonings do they use in preparing the beef that they consume (indicating also for which cooking method they use those seasonings).

Results from this consumer study determined which seasonings were used later in the descriptive study conducted with a trained panel. As a result of the consumer survey nine different beef samples with seasonings and five beef samples without seasonings were chosen for the descriptive study.

2.2. Samples and sample preparation

Beef samples were supplied by Texas A&M University (TAMU). TAMU purchased the samples used in this study from Freedman Meats, Inc. (Houston, TX, USA). The samples were aged for 14 days before being vacuum-packed after being labeled, and stored at approximately −35 °C before use. The age of the animals varied between 18 and 24 months. All samples were from a top butt (*Gluteus medius*, also called: jump, top sirloin, and top sirloin butt) cut and had a Certified Angus Beef® top choice USDA quality grade to avoid sensory differences due to cut or quality grade. All samples, except the ones used for the oven-roasting cooking method, had similar weight and size (~400 g and ~1.5 cm thickness) to facilitate and normalize the addition of seasonings. Oven-roasting samples were approximately twice the size (~800 g and ~3–4 cm thickness) compared with other samples and had double the amount of seasoning compared to the other samples (Table 1 shows the amounts of seasoning added to the samples).

The beef samples were cooked to a medium level of doneness (68.3 °C) by oven-roasting, grilling (electric grill or outside gas grill), stewing, or pan frying. The cooking method was chosen depending on the sample and the results of the consumer study. Beef samples were stored at −26 °C until ready to be evaluated. The grilling, stewing and pan-frying samples were removed from the freezer 24 h prior to cooking and allowed to thaw in the refrigerator. The roast samples were removed from the freezer 48 h prior to cooking to allow samples to thaw completely in the refrigerator. Therefore, temperature of the samples was ~4 °C before the cooking started.

Stewing, oven-roasting, and electric grilling methods were the same ones reported by Adhikari et al. (2011). An aluminum pan with a non-sticking surface (30 cm) was used for pan frying the beef samples. Approximately 45 mL of vegetable oil was added to the pan and heated (on "high" position) until the oil was hot. The sample was then placed in the pan and turned every 2 min while cooking until the target internal temperature (68.3 °C) was reached.

The gas-grill (Weber Q200 portable grill) was set up in a well-ventilated area. Samples were cooked at "medium" power and turned every 5 min until the internal target temperature (68.3 °C) was reached. A temperature probe (Mainstays Black Acu-Rite meat thermometer with probe, model 00993STW1, Lake Geneva, WI) was inserted into the approximate geometric center of each sample to monitor the target internal temperature/endpoint temperature.

2.3. Panelists

Six highly trained panelists from the Sensory Analysis Center at Kansas State University (Manhattan, KS) participated in the study. Each panelist had completed, at least 120 h of general descriptive analysis training and had a minimum of 1200 h of descriptive sensory testing including food products. Panelists also had experience in testing beef and using the beef lexicon developed by Adhikari et al. (2011).

Table 1
Description of the seasonings used for cooking beef as affected by the cooking method and country.

Seasoning	Amount per sample[a]	Country[b]	Cooking method[c]
Vegetable oil	1 tbsp	Argentina, US	G-E, S, P, D
Olive oil	1 tbsp	US, Spain	P, G-E, S
Salt	1 tsp	Argentina, US, Spain	All methods
Dry bay leaves	2 leaves chopped	Spain	S
Fresh garlic	1 clove chopped	Argentina, US, Spain	R, G-B, S
Garlic powder	1 tsp	Argentina, US	R, G-B, P
Onion flakes	1 tsp	US	R, G-B, P
Black pepper	1 tsp	US	R, G-E,G-B, S, P
White pepper	1 tsp	Argentina	S
Fresh parsley	5 g parsley chopped	Argentina	S
Sweet paprika	1 tsp	Argentina	S
Oregano	1 tsp	Argentina	S
Chimichurri	1 tbsp	Argentina	R
Mixed seasoning	1 tsp	US	G-B

[a] Samples used for oven roasting were approximately twice the size (~800 g) of the other samples (~400 g), so the amount of seasonings added were doubled. "tbsp" indicates tablespoon,(~15 mL), and "tsp" indicates teaspoon (~5 mL). The addition of all the seasonings was done before cooking the meat.

[b] More than 30% of respondents from that country used that seasoning in some cooking method.

[c] (R) roasting, (G-E) electric grilling, (G-C) grilling with charcoal, (G-B) grilling outdoor barbecue, (S) stewing/braising, (B) boiling, (P) pan-frying, and (D) deep-frying.