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ScienceDirect
Meat Science 80 (2008) 259–271
MEAT SCIENCE
www.elsevier.com/locate/meatsci

Identifying muscle and processing combinations suitable for use as beef for fajitas

D. Huerta-Montauti, R.K. Miller, C.E. Schuehle Pfeiffer, K.D. Pfeiffer, K.L. Nicholson, W.N. Osburn, J.W. Savell *

Meat Science Section, Department of Animal Science, Texas A&M University, 2471 TAMU, College Station, TX 77843-2471, USA

Received 11 September 2007; received in revised form 26 November 2007; accepted 28 November 2007

Abstract

Four different treatments—control, papain, blade tenderization, and papain + blade tenderization—were applied to sixty USDA Choice *M. diaphragma pars costalis*, *M. transversus abdominis*, *M. obliquus abdominis internus*, *M. rhomboideus*, *M. trapezius*, *M. latissimus*, and *M. serratus ventralis*. Trained ($n = 6$) and consumer ($n = 81$) panelists scored papain samples higher for most sensory traits. Treatment tended not to affect the palatability scores of the *M. diaphragma pars costalis* and *M. serratus ventralis*, which tended to receive higher scores in comparison to the other muscles. Consumers were willing to purchase the *M. latissimus* and *M. serratus ventralis* treated with papain + blade tenderization and papain, respectively, and these muscles performed well enough to be considered as alternatives in the beef fajita market.
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Keywords: Beef fajitas; Papain; Blade tenderization; Sensory panel; Shear force

1. Introduction

Several studies, such as the Bovine Myology and Muscle Profiling (Jones, Burson, & Calkins, 2001) and the Beef Value Cuts program (NCBA, 2001), have identified new steaks and more beef menu options for the consumer. Armed with the goal of increasing the overall value of the beef chuck and round, and thus the entire beef carcass, these attempts focused on the chuck shoulder clod, round tip, and bottom round flat. Success stories from the examination of these subprimals include the now popular flat iron steak, shoulder tender petite medallions, ranch cut steak, tip center steak, and the tip side steak (NCBA, 2001). Studies such as these help to identify potential muscles that may have utility in a number of uses in the foodservice and retail markets.

Beef fajitas are an extremely popular dish served in Mexican restaurants in the US (Recio, Fradella, Cross, Smith, & Savell, 1988). The demand for both inside (*M. transversus abdominus*) and outside skirt (*M. diaphragma pars costalis*) steaks—the principal muscles prepared as fajitas—has dramatically increased, and many entities, especially those in foodservice, need other thin muscle alternatives to serve as fajitas. Thus, there is a need to evaluate alternative muscles from the beef carcass in combination with traditional processing techniques, such as tenderization and marination, to provide the industry and consumers with highly palatable, fajita options in addition to skirt steaks.

2. Materials and methods

2.1. Product selection and fabrication

Specifications for all subprimals complied with Institutional Meat Purchase Specifications (IMPS) as described

* Corresponding author. Tel.: +1 979 845 3935; fax: +1 979 845 9454.
E-mail address: j-savell@tamu.edu (J.W. Savell).

0309-1740/$ - see front matter © 2007 Elsevier Ltd. All rights reserved.
doi:10.1016/j.meatsci.2007.11.026

by USDA (1996) and NAMP. (2003). Sixty USDA Choice Beef Arm Chucks; Beef Plate, Short Plates (IMPS # 121); Beef plate, Outside Skirts (IM–individual muscle) (IMPS # 121C), *M. diaphragma pars costalis*; Beef Plate, Inside Skirts (IM) (IMPS # 121D), *M. transversus abdominis*; and Beef Loin, Bottom Sirloin Butt, Flaps, Boneless (IM) (IMPS # 185A), *M. obliquus abdominis internus* were obtained from a commercial beef packer from one production day and shipped via refrigerated truck to the Rosenthal Meat Science and Technology Center at Texas A&M University.

After arrival (7 to 10 d postmortem), *M. rhomboideus* and *M. trapezius* were removed from beef chucks, and *M. latissimus dorsi* and *M. serratus ventralis* were removed from beef plates. All muscles were stored at refrigerated temperatures (1–3 °C). Muscles were sorted randomly into four groups of approximately 15 pieces. The tenderization treatment groups were: control (C), blade tenderization (B), papain (P), and papain + blade tenderization (P + B).

2.2. Application of treatments

After sorting, control muscles were vacuum packaged individually and frozen. Blade tenderized muscles were passed through the blade tenderizer twice (Tend-R-Rite, Model TR-2, Bettcher Industries Inc., Birmingham, Ohio), once horizontally and once turned over and rotated 90°.

For the papain treatment, a brine mixture (pH 7.2) was formulated consisting of 6.5% salt, 3.5% sodium tripolyphosphate (5000 ppm/0.5% in-going), 89.97% water, and 0.033% papain (Liquipanol® T-100, Enzyme Development Corporation, New York, NY). Muscles were placed in vacuum package bags (Cryovac®, Sealed Air Corporation, Duncan, SC), sufficient brine was added to achieve 10% above the total muscle weight, and bags were sealed without a vacuum in an Ultravac® (Koch Equipment, Kansas City, MO, Model 2100-D) packaging machine. To ensure uniform distribution of the brine treatment, sealed bags were placed in a vacuum tumbler (Leland Southwest, Fort Worth, TX, Model UT500) under a vacuum of 172.37 kPa and rotated at a speed of 11 rpm for 30 min. For the P + B treatment, muscles were blade tenderized before papain was added. After tumbling, muscles were vacuum packaged (Bivac® packaging machine, American Can Company™, American Lane, Greenwich, NJ) and frozen at -10 °C for 10 weeks.

2.3. Muscle sectioning

Frozen muscles were tempered (~5 °C) before slicing into smaller sections. Sections obtained were of different lengths, widths, and thicknesses: *M. serratus ventralis* (~11 cm × 9.5 cm × 2.5 cm), *M. obliquus abdominis internus* (~13 cm × 11 cm × 2 cm), *M. rhomboideus* (~12 cm × 8 cm × 3 cm), *M. latissimus* (~16 cm × 6 cm × 1 cm), *M. diaphragma pars costalis* (~9 cm × 6.5 cm × 0.7 cm), *M. transversus abdominis* (~14 cm × 9 cm × 1 cm), and *M. trapezius* (~10 cm × 9 cm × 0.4 cm).

Sections were identified individually, placed in oxygen barrier bags (Cryovac®, Sealed Air Corporation, Duncan, SC), vacuum packaged using the Ultravac® (Koch Equipment, Kansas City, MO, Model 2100-D), and frozen at -10 °C for subsequent trained panel, consumer panel, and Warner–Bratzler shear force (WBSF) evaluation.

2.4. Cooking procedures

Randomly selected sections were thawed for 48 h at 5 °C. Sections were cooked on a Hamilton Beach Portafolio Indoor/Outdoor Grill (Hamilton Beach/Proctor-Silex, Inc., Southern Pines, NC), and internal temperature was monitored by the use of handheld Omega Type T thermometers. Upon reaching an internal temperature of 35 °C, sections were turned and removed at 70 °C. Cooked sections were wrapped in aluminum foil and held in an oven (Alto-Shaam®, Halo Heat, Model 750-TH-II, Alto-Shaam, Inc., Milwaukee, WI) at ~50 °C for no more than 20 min.

2.5. Trained sensory panel

A six-member expert meat and flavor descriptive attribute panel (trained as defined by AMSA, 1995, and Meilgaard, Civille, & Carr, 1999) was used. Panelists were familiarized for two days with samples that would be used in the study. They were seated in individual booths equipped with red lights, and received cooked, unseasoned beef top loin steak cubes as warm-up samples. Analyses were performed over ten sensory days.

Cooked sections were cut into 1 cm^3 cubes, placed in plastic weigh boats, and served immediately. Each day, panelists evaluated 14 samples, served 5 min apart, during two sessions (seven samples per session) with a 15 min break between sessions. Panelists cleansed their palate between samples with double-distilled deionized water and whole milk ricotta cheese.

Trained panelists evaluated juiciness, muscle fiber tenderness, connective tissue, and overall tenderness of beef samples using 8-point scales (1 = extremely dry, extremely tough, abundant, and extremely tough; 8 = extremely juicy, extremely tender, none, and extremely tender, respectively). Panelists also evaluated the aromatics: cooked beef lean, cooked beef fat, serumy/bloody, burned/burnt, chemical; mouthfeels: astringent and metallic; tastes: salt, sour, bitter, and sweet; and aftertastes: acid, sour, brown, chemical, fat, salt, bitter, serumy/bloody, metal, and burn using a 9-point scale (0 = none and 8 = extremely intense).

2.6. Consumer sensory panel

Consumers were selected randomly from the Bryan/College Station, TX phone book. To participate in the study, consumers were screened using a telephone script that

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