KEYNOTE ADDRESS

Meat Science Experiences in Latin America: Applications in Trade

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INTRODUCTION

One hundred years ago, Armsby (1910) urged increased production of foods to keep pace with intense demand by future US populations. Now, it seems that we did a good job of producing more food, not only domestically but worldwide (FAO, 2010). Consumption of livestock products has increased rapidly in developing countries. Since the pioneering shipment of chilled beef from the United States to Great Britain in 1874 (Troubridge Critchell and Raymond, 1912), exports of US red meat and processed products have grown tremendously, totaling 2.77 million MT (US$7.44 billion in value) in 2009 (USDA, 2010). Since the early 1960s, developing countries have more than tripled per capita consumption of meat (FAO, 2010). This growth also was noticeable in Latin America (LA), particularly from the 1980s onward when Brazil, the world's largest beef exporter and second-largest poultry exporter (Global Trade Atlas, 2010), almost doubled its meat consumption (FAO, 2010). Furthermore, JBS-Friboi, which is arguably Brazil's best-known company, is a world meat processing leader. These signals force us to reflect on Brazil's success story and keep our eyes toward the south, where popular beliefs and cultural preferences are real challenges for promoting and marketing US meats.

Focus groups [US Meat Export Federation (USMEF), unpublished results] have revealed that (a) although US beef has, in general, a good image, it is perceived as more expensive than domestic counterparts; (b) there is a lack of knowledge on intrinsic attributes of the product or emotional values that will help to generate motivation for its consumption; (c) lighter color of fresh cuts could be associated with undesirable frozen meat; (d) intrinsic meat flavor is masked with sauces and heavy spices (their own *sazón*) when cooked; (e) meat is served well done (especially among women), disregarding rare or medium-rare degrees of doneness; and (f) tolerance to eat less than well-done pork is very rare, a custom rooted in safety concerns for trichina and cysticercus. Nationalisms and regionalisms join cultural misperceptions to question the quality of imported meats. These matters are leveraged by protectionist livestock leaders and politicians who publicly discredit quality and safety of foreign competition. Hence, building scientific arguments can help to prevent issuance and application of unfounded, precautionary regulations and mitigate effects of misleading campaigns by streamlining marketing efforts in the marketplace. This presentation will discuss the status of meat science in LA and studies aimed at supporting trade in foreign markets.

MEAT SCIENCE IN LATIN AMERICA

Huerta-Leidenz et al. (2010a) and Arenas de Moreno et al. (2010) reported results of a 2010 survey of 108 faculty members in 58 universities and research institutes of 11 countries of LA as follows: (a) Almost half of the respondents (45.4%) were working at the main exporting countries of the Southern Cone (Argentina, Brazil, Chile, and Uruguay), followed by Colombia and Venezuela (29.6%) and Mexico (21.3%). (b) There were a small number of meat scientists contacted in the Central American and the Caribbean region and none from the rest of South America. (c) Doctorate degrees were held by 66.7% of the respondents, but only one-fourth earned their degrees in the United States. (d) Most respondents focused on applied and basic research in production factors and quality (77.8%), sensorial attributes (75.9%), carcass evaluation (69.2%), food safety (67.6%), and nutritional quality (61.1%). (e) About half of them work in growth and development (51.9%) and animal welfare (52.3%), whereas lower proportions of the respondents were engaged in the use of molecular techniques to predict quality (42.1%) or in consumer research (40.2%). (f) Most institutions (74.1%) have developed graduate programs at the master's level, and 56.9% offer doctoral degrees. (h) Many institutions have chemistry (79.3%), microbiology (69.0%), and food processing (62.1%) laboratories. (i) Over half of them have sensory evaluation (58.6%) and molecular biology (51.7%) laboratories, whereas a little more than one

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third (36.2%) have slaughtering and carcass evaluation facilities. (j) The American Meat Science Association was known by 91.3% of the respondents, but only one-fourth has attended the Reciprocal Meat Conference. (k) Research was mostly supported by the government (39.9%), followed by their own institution (33.9%). (l) Most respondents earned a monthly salary between US$1,500 and 2,500, and the overall mean was US$2,262.40. As a reference, the median annual wage of US food scientists and technologists was US$59,520 in 2008, whereas the average federal salary for US animal scientists in 2009 was US$104,184 (Bureau of Labor Statistics, 2009). These results suggest that meat science is quite incipient or nonexistent in most LA countries, opening windows of opportunities for American researchers. Also, scientific capabilities in Mexico, the Southern Cone, and the main countries of the Andean subregion allow for the establishment of goodwill, collaborative programs with both the academic and industry sectors of the United States.

APPLICATIONS OF MEAT SCIENCE IN THE INTERNATIONAL TRADE

Science has never been and will not ever be naïve, but history of meat trade has shown a more controversial situation; many precautionary regulations or protectionist postures are based on nonscientific arguments. Therefore, science and scientific principles are now acknowledged and integrated into the language of international trade agreements, providing the basis for developing international standards, guidelines, or recommendations in organizations such as Codex Alimentarius Commission, the International Office of Epizootics, and other international and regional organizations (WTO, 2002). Still, many sanitary and phytosanitary issues persist, such as a *Salmonella* zero tolerance regulation for domestic raw meats of Mexico that can eventually be applied to imported meats to prevent their access, which has already happened in some Central American countries (El Salvador, Honduras, and Costa Rica). In these cases, prevalence studies demonstrating the rampant presence of this pathogen in the local meat markets, as has been recently found in Mexico (Pond et al., 2010), might help to prevent the application of such regulations to imported fresh meats. Other opportunities for meat science in support of marketing and that facilitate meat trade could be exemplified by three study cases in LA: 1) development and validation of systems of beef classification and grading, 2) comparison of US meats versus LA counterparts, and 4) predominant leanness of US red meats in the Mexican retail markets.

DEVELOPMENT AND VALIDATION OF MEAT CLASSIFICATION AND GRADING SYSTEMS

Marketing requirements for agricultural goods have sometimes become technical barriers to free trade agreements. For instance, some northern states of Mexico recently have attempted to use local beef grading to restrict access of out-of-state beef. Shearer et al. (2009) pointed out that only 6 of 33 regional agreements (the North American Free Trade Agreement included) contain specific provisions for technical barriers to agricultural trade, reinforcing the commitment to the principle of national treatment when applying measures related to classification, grading, and marketing of agricultural goods. However, only the Chile-US Free Trade Agreement has specified the mutual recognition of each country's beef grading systems and cuts nomenclature, and there are clear indications that Panama will follow a similar pathway (Shearer et al., 2009). Ideally, harmonized or equivalent quality standards (e.g., classification and grading systems) among trading partners would further facilitate communication in meat trade. In 1983 the Andean Community of Nations (CAN) agreed on guidelines for beef grading (CAN, 1983) involving carcass segregation by types (sex class and age determined by either skeletal maturity or dentition) and by assessment of conformation, degree of finish (marbling included), and "characteristics of muscles and adipose tissues" as grading factors. Clearly, the CAN region is a promising area for the establishment of equivalency with the US system (USDA, 1997), where marbling and physiological maturity are the primary quality-determining factors. However, only Colombia and Venezuela from CAN and another 7 out of the 19 LA countries have some sort of beef classification system (Table 1). Except for Venezuela, none has the potential to adopt a dual system (quality and yield) or use marbling and physiological maturity as quality factors, and none have been scientifically validated (Table 1). In 1992, after 10 years of experiencing four beef classification systems, Venezuela became the first signatory nation to adopt the CAN guidelines and launched another beef carcass grading standard in 1994 (Decreto Presidencial No.181, 1994). Personnel of the USDA Agricultural Marketing Service (M. O'Connors) and Texas A&M University (K. E. Belk) joined Venezuelan researchers of La Universidad del Zulia in training graders to proceed with the validation process. Flaws of the system (Huerta-Leidenz et al., 1996) forced revision of evaluation criteria and operational implementation. Sensorial and shear force data of rib (longissimus) steaks from Zebu-type, grass-fed bull, steer, and heifer carcasses were subjected to correlation analyses to study relationships of carcass traits to eating-quality attributes (Huerta-Leidenz et al., 1997a,b).

Their main findings in steers and heifers (as a composite group, n = 261) were as follows: (1) Significant, positive relationships were found between external fat estimators and tenderness and flavor ratings, whereas marbling amount—at the levels found (slight to practically devoid)—was inversely related to tenderness, flavor, and juiciness ratings. (2) An adipose maturity score (5-point scale for fat color) was used to adjust for a final maturity score or index, which was significantly (r = 0.45) related to shear force. (3) Carcass quality indicators did not account individually for more than 20% of the total variation observed in beef quality attributes. In bulls (n = 419), significant relationships were found between external fat estimators and most of the attributes under study, whereas

Table 1. Beef carcass official classification/grading systems by US and Latin American countries in terms of type, vertical recognition, amplitude, precision, and validation status[1]

		Recognition					Amplitude			Precision		Validation	
Country	Type	Integral (producer-retail/port)	Producer-packer	Packer-distributor	Packer-retail	Packer-port	Yield grade	Quality grade	Grade for yield and quality	Instrument	Staff	Technical	Other
Argentina[2]	Fd M (Ore)	—	—	X	—	X (HC)	—	—	X	—	X (HC)	—	—
Brazil[3]	Fd (V)	—	—	—	—	X (HC)	—	—	X	—	X (HC)	—	—
Chile[4]	Fd (M)	—	X	X	X	X	—	—	X	—	X	—	—
Colombia[5]	Fd (Na)	—	P	P	P	P		—	X	—	X	—	—
Costa Rica[6]	Exp	—	—	—	—	—	—	—	P	—	—	P	—
Mexico[7]	St (V)	—	P	X	X	—	—	X	—	P	X	—	—
Panama[8]	Fd (M, Na)	—	—	—	P	—	—	—	X	—	X	—	—
Uruguay[9]	Fd (M)	—	—	X	—	X	—	—	X	P	X	—	—
USA	Fd (V)	X					X	X		X	X	X	X
Venezuela10	Fd (M)	—	X	X	X	—	P	P	X	—	X	X	X

[1]Recognition: the visibility level of the system by segments of the meat chain value, in a vertical mode (streams up/down); Amplitude: the kind of information generated by the system; Precision: the objectivity and degree of accuracy of the system, whether it is executed by instruments or by qualified staff; Validation status: whether the system has proven its ability to segregate quality and yield performance by grade, category, or classes (technical validation). "Other" validations may include demonstration of its operational feasibility or ability to discriminate commercial value among grades, classes, and categories. Type definitions: M: mandatory; Fd: federal; V: voluntary; Ore: only required for export; St: state based; Na: proposed but not yet applicable; Exp: experimental status. P: potential application; HC: for Hilton quota only.

[2]Argentinean classification takes into account categories of sex class, skeletal maturity, and carcass weight, and grades are based on conformation and finish (de Felício, 2010). Grades have been incorporated in the mandatory Argentinean traceability system gaining a wider recognition (G. Grigioni, personal communication).

[3]Brazilian current grading is based on sex, class, age by dentition, finish, and conformation. A new, mandatory grading regulation (passed in 2004) included carcass weight, but it has not been applied (de Felício, In press).

[4]Chilean grading is based on sex class, age by dentition, and finish (Gallo et al., 1999).

[5]Colombian grading is based on sex class, age by dentition, finish, conformation, and carcass weight (I. Amador, personal communication).

[6]Under test and validation by the Costa Rican Cattlemen Corporation (CORFOGA) (J. Rodriguez, personal communication).

[7]Mexico passed an official (federal) beef grading regulation, although it is not yet applicable; state-based grading systems in northern states of Mexico are following similar USDA quality criteria.

[8]Panamanian grading is based on sex class, age by dentition, conformation, finish, and carcass weight (C. Ayala, personal communication).

[9]Uruguayan classification is based on classes and subclasses (age by dentition and sex) and grades based on type (finish and muscling) with certain carcass weight requirements (de Felício, 2010). This is mandatory for all packing houses under control of the Uruguayan Meat Institute (INAC).

[10]Only mandatory in packing houses under the control of the Venezuelan Ministry of Agriculture. A new Venezuelan dual grading system has been passed (Venezuelan decree 1896, 1997), but it has not been applied. Venezuelan grading is currently based on sex class, physiological maturity, muscling, and finish (Decreto Presidencial No. 181, 1994).

marbling scores were not significantly related to any of them. (4) Carcass quality indicators did not account individually for more of 15% of the total variation observed in beef quality attributes.

Hence, external fat measures and a final maturity estimator adjusted by fat color had to be used to design a new carcass grading system for Venezuela (Decreto Presidencial No. 1896, 1997). One of the lessons learned was that there is one single and clear difference between beef production in Venezuela (and several tropical LA countries) and that in the United States: the predominance of grass-fed bulls of *Bos indicus* influence. Malaver et al. (2000) documented the failure of the two Venezuelan systems to effectively segregate bull carcasses into groups of distinct quality characteristics. As reported by de Felício (In press), most of the present classification systems of South America have fatness and conformation scores that resemble those of the European Union (where, coincidentally, the production of bulls also predominates). Hence, the lack of harmonization of equivalence of the US beef grading system (USDA, 1997) with those of LA remains an important challenge for regional trade. Undoubtedly, the scientific design and validation of a standard meat classification and grading system for the American continent is pending; it would serve to provide a common language for beef trade in the Americas.

COMPARISON OF US MEATS VERSUS LA COUNTERPARTS

Red meats from the United States are usually criticized in LA for being too tender and (or) greasy. Also, it is commonly believed that many LA consumers—accustomed to the strong flavor of relatively old, grass-fed beef—are not pleased with the taste of US beef due to its bland flavor.

Table 2. Summary of studies comparing US beef versus Latin American counterparts in selected eating quality attributes[1]

	Shear force					Flavor					Tenderness							Desirability			
	1	2		4	5	2		3	5		1	2		3	4	5		1	2	2	3
Origin/grade	Ld	Ad	Sm	Cp	Cp	Ad	Sm	Ld	Ld	Bf	Ld	Ad	Sm	Ld	Cp	Ld	Bf	Ld	Ad	Sm	Ld
USA																					
Choice	3.0^{a}	3.5^{a}	4.5^{a}		2.7^{a}	4.6	4.5		7.4^{a}	5.2^{d}	5.3^{a}	5.5^{a}	5.2^{a}			7.2^{a}	7.2^{a}	5.2^{a}	5.2^{a}	5.0^{a}	
Select	—	3.5^{a}	4.7^{a}			4.9	4.6					5.1^{ab}	5.2^{a}						5.0^{ab}	5.2^{a}	
Ungraded	4.6^{b}			2.8^{a}				5.9^{a}			4.6^{b}			5.8^{a}	6.5^{a}			4.6^{b}			5.7^{a}
Mexico																					
North	3.6^{c}										5.1^{a}							5.4^{a}			
Central	4.6^{b}										4.4^{b}							5.3^{a}			
South	4.7^{b}										4.2^{b}							5.1^{a}			
AgC/Verc[2]		4.9^{b}	6.2^{b}			4.5	4.5					4.9^{b}	4.3^{b}						4.8^{ab}	4.5^{b}	
Argentina								4.6^{b}						5.1^{b}							4.6^{b}
Costa Rica				3.1^{a}											5.3^{b}						
Puerto Rico				4.1^{b}											5.0^{b}						
Venezuela[3]																					
AA					3.2^{b}				6.1^{b}	5.8						6.3^{b}	6.4^{ab}				
A					3.5^{b}				4.8^{c}	5.2						5.4^{b}	5.5^{b}				

[a–d]Within a column, means without a common superscript letter differ ($P < 0.05$).

[1]Source: 1 = Delgado et al. (2005), 2 = Rubio et al. (2007), 3 = Killinger et al. (2004), 4 = Acevedo-Salinas (2004), 5 = Huerta-Montauti et al. (2008). Muscle under study: Ld = longissimus dorsi, Ad = adductor, Sm = semimembranosus, Cp = composite of two or more muscles, Bf = biceps femoris.

[2]AgC/Verc = Aguas Calientes and Veracruz States.

[3]For the Venezuelan trial, "Choice or higher" beef items were used to represent the US beef samples (Huerta-Montauti et al., 2008).

Delgado et al. (2005) suggested that the relatively high overall desirability score assigned to all sources of Mexican beef was comparable to those for USDA Choice beef—despite significant differences found to occur in Warner-Bratzler shear force values and tenderness ratings—and hypothesized that their satisfaction with Mexican beef may have been caused by familiarization of Mexican consumers with the taste, flavor, and aroma of the locally produced beef. Tables 2 and 3 summarize a series of studies published in the last five years comparing key sensorial attributes and proximate components of US beef versus LA counterparts. Except for those conducted in Puerto Rico (Acevedo-Salinas, 2004) and northwestern Mexico (Gonzalez-Rios et al., 2010), all made use of consumer panels. In general, results indicated (a) superior attributes of US beef of Select or higher USDA grades pleased different consumers groups; (b) the use of no-roll, or ungraded, US beef yielded less consistent results with little differentiation or was less desirable than local beef; and (c) alleged claims in flavor deficiencies of US beef were not supported by these sensorial studies. In the Venezuelan experience (Huerta-Montauti et al., 2008), "Choice or higher" ribeye steaks unexpectedly obtained the highest ($P < 0.001$) consumer ratings for flavor and flavor intensity and rated highest in acceptability (79.7%). Furthermore, the composite of US beef samples exhibited an outstanding proportion (94%) of tender steaks (shear force value less than 3.88 kg; Huerta-Montauti et al., 2008).

In Mexico, where most of the imported US beef is derived from rounds and chucks, González-Ríos et al. (2010) compared ungraded beef knuckles (m. vastus lateralis) from Northwestern Mexico (NMEX) and their counterpart imported from the United States. United States-imported, nongraded vastus lateralis samples exhibited lower shear values (4.50 vs. 6.07 kg) and were rated as more tender (6.21 vs. 5.38) than their NMEX counterparts ($P < 0.05$). These results were consistent with the report of Rubio et al. (2007) using the adductor and semimembranosus muscles from inside rounds. Regarding comparative studies on proximal composition (Table 3), the two most relevant observations were (a) small or no significant differences in protein content and (b) US beef samples generally exhibited significantly greater fat content. The latter trend could support the claims that US red meats are greasy and unhealthy. Nevertheless, from a health standpoint, attention should also be given to the nutritional quality of the fat. The primary findings of the González-Rios et al. (2010) study were (1) longissimus muscles from NMEX had a higher (16.44 vs. 14.43%) content of stearic acid (C18:0); (2) vastus lateralis from the United States showed a higher

Table 3. Summary of studies comparing US beef versus Latin American counterparts in selected proximate components[1]

	Moisture (%)					Fat (%)						Protein (%)				
	1	2		4		1	2		3	4		1	2		4	
Origin/grade	Ld	Ad	Sm	Ld	Bf	Ld	Ad	Sm	Cp	Ld	Bf	Ld	Ad	Sm	Ld	Bf
USA																
Choice	69.9[a]	73.1	70.9[a]	68.2[a]	71.7[a]	6.3[a]	3.8[a]	4.7[a]		8.0[a]	6.0[a]	21.7	19.5[a]	21.1	21.9	19.9
Select		73.7	72.9[a]				3.6[a]	3.6[b]					19.9[ab]	20.6		
Ungraded	73.1[b]					2.9[b]			4.0[a]			22.2				
Mexico																
North	72.9[b]					3.0[b]						21.7				
Central	73.6[b]					2.7[b]						22.3				
South	72.2[b]					3.6[b]						22.3				
AgC/Verc[2]		73.8	73.3[b]				2.7[b]	3.1[b]					20.6[b]	20.8		
Costa Rica									1.2[b]							
Puerto Rico									1.8[b]							
Venezuela[3]																
AA				74.0[b]	74.3[b]					3.0[b]	4.2[b]				21.5	20.3
A				74.7[b]	74.4[b]					2.0[b]	3.5[b]				21.9	20.5

[a,b]Within a column, means without a common superscript letter differ ($P < 0.05$).

[1]Source: 1 = Delgado et al. (2005), 2 = Rubio et al. (2007), 3 = Acevedo-Salinas (2004), 4 = Huerta-Montauti et al. (2007). Muscle under study: Ld = longissimus dorsi, Ad = adductor, Sm = semimembranosus, Cp = composite of three muscles, Bf = biceps femoris.

[2]AgC/Verc = Aguas Calientes and Veracruz States.

[3]For the Venezuelan trial, "Choice or higher" beef items were used to represent the US beef samples (Huerta-Montauti et al., 2007).

concentration of essential linoleic acid (7.22 vs. 5.52%) and linolenic acid (0.42 vs. 0.32%), as well as a higher ($P < 0.05$) polyunsaturated:saturated fatty acid ratio (0.23 vs. 0.18); and (3) the relatively low values for cholesterol content did not vary ($P > 0.05$) between samples of different origin.

Huerta-Montauti et al. (2007) have conducted the only comparative study addressing mineral composition of beef. Interestingly, Venezuelan workers found that US "Choice or higher" samples contained higher Ca, Fe, and Zn and lower P and K concentrations compared with domestic (AA and A grades) samples.

The first study comparing compositional, physical, and chemical properties and consumer acceptability of pork samples from the United States and Mexico was by Méndez-Medina et al. (2009). They observed that (a) properties of rectus femoris, vastus medialis, and longissimus dorsi from Mexico and the United States were quite similar, although Mexican pork samples generally were more variable. (b) Longissimus dorsi samples from the United States had greater ($P < 0.05$) water-holding and emulsifying capacities, whereas both rectus femoris and longissimus dorsi from the United States required lower shear force ($P < 0.05$) compared with Mexican counterparts. (c) Ratings from Mexican consumers did not indicate preference for pork from any of the countries.

In general, such comparative studies, especially when conducted by local research groups at the targeted marketplaces, generate credibility and provide technical support to marketing efforts as they endeavor to counter arguments regarding misperceptions, biased information, or misleading claims. Obviously, reported differences observed in meat nutrient composition among US samples and LA counterparts deserve further attention from a nutritional standpoint. Because of the limited number of observations for the samples surveyed in several of these studies, the results should be considered as preliminary and may not adequately characterize the populations of each country, but they did reveal important trends for selected traits of US red meats currently available in the LA markets.

US MEAT LEANNESS AUDITS IN MEXICO

Mexico is still by far the leading volume destination for US red meat exports (USMEF 2009 estimates, unpublished results). However, Mexican consumers do not tolerate subcutaneous (fat cover) and intermuscular (seam) fat in excess (fatty bits "being rejected by children"), and marbling specks are not recognized as a positive attribute but commonly associated with the amount of connective tissue and toughness (USMEF, focus group studies, unpublished results). Frequent criticisms regarding unacceptable amount of fats (plate waste) in the US red meats have

Table 4. Descriptive statistics for leanness indicators of US meats retailed in Mexico[1]

Species	Trait	n	Overall mean	SD	Minimum value	Maximum value
Beef	Fat cover	1,173	0.10	0.20	0.00	1.27
	Seam fat	1,172	0.12	0.22	0.00	1.91
	Marbling[2]	1,054	2.99	1.37	1.00	6.00
	USDA grade[3]	951	2.71	0.47	1.00	3.00
Pork	Fat cover	388	0.07	0.15	0.00	0.64
	Seam fat	388	0.10	0.15	0.00	0.64
	Marbling	349	2.30	1.05	1.00	6.00

[1]Source: Huerta-Leidenz and Ledesma (2010).
[2]Marbling levels correspond to a 6-point descriptive scale, where 1 = practically devoid; 6 = moderate.
[3]USDA quality grades (USDA, 1997) correspond to a 3-point descriptive scale, where 1 = Prime, 2 = Choice, and 3 = Select.

been recently challenged in Mexico by Huerta-Leidenz and Ledesma (2010). Results of audits at different Mexican retail outlets throughout the country during January and April 2008 are shown in Table 4. In both species, mean thickness for cover and seam fats of retail cuts were close to one-tenth of a centimeter, and the average score for marbling in beef and pork was close to Slight and Traces, respectively (Table 4). In a follow-up report, Huerta-Leidenz et al. (2010b) indicated that (a) the five most common beef cuts (bottom round or flat, top round, knuckle, eye of round, and neck + chuck roll) represented 52.3% of the total meat merchandised and (b) most of the beef retail cuts (93.0%) were trimmed to less than 0.32 cm of fat cover for retailing ($P < 0.05$) and the average thickness of seam fat was less than 0.32 cm in 94.4% of the beef cuts.

Overall, these findings indicated that, given present merchandising practices, Mexican retailers are trying to please the local preference for leaner, affordable, and convenient beef items by fabricating and denuding US beef cuts, mostly derived from rounds and chucks of USDA Select carcasses (Huerta-Leidenz et al., 2010). The findings of Huerta-Leidenz and Ledesma (2010) on the US retail meat leanness status in Mexico, along with their instructions for calculating its nutrient composition according to the USDA (2008), were published for the very first time in the 2010 commemorative edition of the Tables of Food Composition of the Mexican Institute of Nutrition (Huerta-Leidenz and Ledesma, 2010).

CONCLUSIONS

Meat science is incipient in most LA countries. Areas of opportunity for developing collaborative meat science programs exist with private and public American institutions because important common elements (topics and research demands) exist across the identified meat research groups. Besides fulfilling its fundamental, academic purposes, meat science serves trade through important functions. (1) Meat science creates knowledge for educating consumers, regulators, and other stakeholders in the marketplaces. (2) It is useful in addressing crucial problems of meat trade worldwide, such as sanitary and phytosanitary issues and technical barriers. (3) It counteracts unfair and biased claims from competitors. (4) Meat science also provides storytelling for marketing strategies and tactics. Clearly, there are some fairly important reasons for the existence of these stories. They give us the opportunity not to show bad and good products but to show a lot of trading options for any meat product produced in the Americas. That is what marketing is all about.

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