BIOCHEMICAL CHARACTERIZATION OF BEEF TONGUE AS VALUE-ADDED MEAT PRODUCT

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I. OBJECTIVES

This research study was undertaken to evaluate and characterize the physicochemical properties of beef tongue as a meat product. Specifically, objectives were to (1) determine the proximate composition, proteomic profile, and lipid profile of beef tongue; and (2) evaluate the fiber type, connective tissue, and histological composition (muscle structure, fiber size, and fiber type) of beef tongue.

II. MATERIALS AND METHODS

Proximate composition including sarcoplasmic and myofibrillar protein fractions ($n = 6$) were determined from the anterior, anteromedial, posteromedial, and posterior regions of a thawed, peeled beef tongue. Protein profiling ($n = 3$) was performed using liquid chromatography-mass spectrometry (MS) analysis on the isolated sarcoplasmic fractions of beef tongue and *L. dorsi*. An LTQ Orbitrap Elite Mass Spectrometer coupled with a Proxeon Easy NanoLC system was used for MS analysis of the samples. MS data were acquired by the data-dependent acquisition method. The MS and MS/MS scans were acquired at resolutions of 120,000 and 30,000, respectively. Fatty acid composition ($n = 6$) was analyzed by derivatizing fatty acid to methyl esters before being analyzed by gas chromatography-flame ionization detection. Adenosine triphosphatase staining was performed to determine the percentage of type I (slow-twitch) and type II (fast-twitch) muscle fibers in beef tongue.

III. RESULTS

Proximate composition analysis of beef tongue revealed differences in moisture, protein, fat, and ash content along the length of the tongue. The anterior and anteromedial regions exhibited lower ($P < 0.05$) percent fat values than the posteromedial and posterior regions. The protein band patterns resulting from the separations reveal that beef tongue has a protein profile distinct from both *L. dorsi* and heart muscles. The band pattern seen in the myofibrillar fraction of beef tongue more closely resembles that of *L. dorsi* than that of heart. However, beef tongue's sarcoplasmic fraction band pattern is distinct from that of *L. dorsi*. It more closely resembles that of heart than that of *L. dorsi*. Polyunsaturated fatty acids constituted a smaller percentage of fatty acids in all regions of the tongue compared with monounsaturated fatty acids and saturated fatty acids. The sarcoplasmic protein fraction of beef tongue has an abundance of mitochondrial proteins and enzymes involved in oxidative metabolic pathways compared with other skeletal muscles. The majority of beef tongue muscle fibers are type I (75%; slow-twitch) oxidative fibers. The surface of the anterior region of beef tongue is the only location where type II (60%; fast-twitch) glycolytic fibers predominate.

IV. CONCLUSION

Our findings indicate that the anterior region of beef tongue has higher protein and lower fat content than the posterior. The findings also show that the fat content of the anterior region is richer in polyunsaturated fatty acids and lower in saturated fatty acids than the posterior, and that the dominant fatty acid in beef tongue is the monounsaturated fatty acid oleic acid (C18:1 n-9). Primarily oxidative muscles are abundant in mitochondria and are known for higher tenderness. The findings of this study therefore indicate that beef tongue is also likely to produce a tender meat product.

Keywords: beef tongue, meat quality, fiber type, sarcomere, fatty acids, protein