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Ractopamine Influences Muscle Proteome Profile of Postmortem Beef Longissimus Lumborum

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Objectives

Ractopamine is a β-adrenergic agonist approved for use in cattle and pigs as a repartitioning agent to increase muscle deposition and potentially limit fat deposition. While the effects of ractopamine on proteome profile of postmortem pork muscles have been examined recently, its influence on beef muscle proteome has not been evaluated. Therefore, the objective of this study was to examine the effects of ractopamine on muscle proteome of postmortem longissimus lumborum (LL) from beef cattle.

Materials and Methods

Crossbred steers housed in pens were fed either a corn-based basal diet (CON) or a diet top-dressed with Optaflexx 45 (Elanco Animal Health) to provide 400 mg of ractopamine hydrochloride/steer per day (RAC). Ractopamine was fed the last 28 d before slaughter. Steers were harvested, and carcasses were chilled. The LL muscle samples were obtained from the carcasses of 9 (n = 9) RAC and CON steers 24 h postmortem. The muscle samples were individually vacuum-packaged and frozen at –80°C for proteome analysis. Whole-muscle proteome was analyzed using 2-dimensional electrophoresis, and the digital gel images were analyzed. The protein spots exhibiting more than 1.5-fold intensity differences ($P < 0.10$) between RAC and CON were subjected to in-gel tryptic digestion and were identified by tandem mass spectrometry.

Results

Five differentially abundant protein spots identified were of greater ($P < 0.10$) abundance in LL samples from RAC compared to those from CON. The proteins identified were F-actin-capping protein subunit β2, PDZ and Lim domain protein-3, heat shock protein β-1, myoglobin, and L-lactate dehydrogenase A chain. The differentially abundant proteins belong to 4 functional groups; i.e., skeletal muscle organization (F-actin-capping protein subunit β2, and PDZ and LIM domain protein-3), chaperone activity (heat shock protein β-1), oxygen transportation (myoglobin), and energy metabolism (L-lactate dehydrogenase A chain).The over-abundance of F-actin-capping protein subunit β2 as well as PDZ and LIM domain protein-3 in RAC may be attributed to the increase in myofibrillar protein synthesis and increase in muscle mass as a result of ractopamine feeding. Heat shock protein β-1 is a chaperone that protects muscle proteins, and its increased abundance in RAC compared to CON may be due to the increased muscle protein synthesis. The over-abundance of myoglobin could possibly result from the increased oxygen consumption due to additional muscle mass accretion in RAC compared to CON, whereas the increased levels of L-lactate dehydrogenase A chain in RAC could potentially be due to the shift of muscle fiber type.

Conclusion

The findings indicated that feeding ractopamine to steers influences the abundance of proteins involved in skeletal muscle organization, chaperone activity, oxygen transportation, and energy metabolism in postmortem beef LL muscle.

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