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Ractopamine-Induced Changes in the Mitochondrial Proteome of Postmortem Beef *Longissimus Lumborum*

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Objectives

Ractopamine is a β-adrenergic agonist approved as growth promotant in beef cattle, and it increases muscle deposition while limiting fat deposition. Dietary ractopamine causes a muscle fiber shift in cattle, and the biochemistry of mitochondria in postmortem beef skeletal muscles is influenced by fiber type. Therefore, dietary ractopamine may potentially affect mitochondrial functionality. Nonetheless, the influence of ractopamine on beef skeletal muscle mitochondrial proteome has not been evaluated. Therefore, the objective of this study was to examine the effects of ractopamine on mitochondrial proteome of postmortem longissimus lumborum (LL) from beef cattle.

Materials and Methods

Pen-housed crossbred steers 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 prior to the harvest. The animals were harvested, and carcasses were chilled for 24 h. The LL muscle samples were obtained from nine (n = 9) RAC and nine (n = 9) CON carcasses. Mitochondrial proteome was analyzed using two-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

Seven differentially abundant proteins were identified in the mitochondrial proteome. Three proteins were over-abundant ($P < 0.10$) in RAC, whereas four spots were over-abundant in CON. The proteins over-abundant in RAC mitochondrial proteome was complement component 1 Q subcomponent-binding protein, very long-chain specific acyl-CoA dehydrogenase, and aconitate hydratase. On the other hand, ATP synthase subunit β, prohibitin, Cytochrome *b*-c1 complex subunit, and thioredoxin-dependent peroxide reductase were over-abundant in CON samples. The differentially abundant proteins belong to four functional groups; i.e., energy metabolism (ATP synthase subunit β, Cytochrome *b*-c1 complex subunit 1, and aconitate hydratase), chaperone activity (complement component 1 Q subcomponent-binding protein and prohibitin), antioxidant activity (thioredoxin-dependent peroxide reductase), and lipid metabolism (very long-chain specific acyl-CoA dehydrogenase).

Conclusion

Dietary ractopamine impacts mitochondrial proteome in postmortem beef LL muscle and influences the abundance of proteins involved in cellular metabolism and protective mechanisms. The increased protein synthesis and leanness previously reported in ractopamine-fed cattle may be attributed to the decreased expression of enzymes involved in respiratory electron transport pathways and the increased expression of enzymes involved in lipolysis.