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Supranutritional Supplementation of Vitamin E Influences the Abundance of Antioxidant Proteins in Postmortem *Longissimus Lumborum* from Heifers

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Objectives

Vitamin E is a lipid-soluble antioxidant that can inhibit lipid oxidation and improve beef color stability. The effect of vitamin E on fresh beef color, from the standpoint of lipid oxidation-induced myoglobin oxidation, have been extensively studied. However, the influence of vitamin E on sarcoplasmic proteome profile of beef skeletal muscles is yet to be investigated. Therefore, the objective of this study was to examine the effect of dietary vitamin E on sarcoplasmic proteome of postmortem beef longissimus lumborum (LL) muscle.

Materials and Methods

Crossbred heifers, managed with a GrowSafe feeding system, were fed ad libitum corn-based diet containing either no supplemental (CONT) or 1000 IU vitamin E/heifer per day (VITE) for 89 d. The animals were harvested, and carcasses were chilled. The LL muscle samples were obtained from the carcasses of nine (n = 9) VITE and nine (n = 9) CONT heifers 24 h postmortem. The muscle samples were individually vacuum-packaged and frozen at –80°C for proteome analysis. Sarcoplasmic proteome was analyzed using two-dimensional electrophoresis, employing immobilized pH gradient strips (pH 3–10; 17 cm) in the first dimension and 12% sodium dodecyl sulfate polyacrylamide gel electrophoresis in the second dimension. The gels were scanned, and the digital gel images were analyzed. The protein spots exhibiting more than 1.5-fold intensity differences ($P < 0.10$) between VITE and CONT were subjected to in-gel tryptic digestion and were identified by tandem mass spectrometry.

Results

Five differentially abundant spots were identified using mass spectrometry, and all the spots were over-abundant in CONT. The proteins in the differentially abundant spots were antioxidant proteins (thioredoxin-dependent peroxide reductase, peroxiredoxin-6, and serum albumin) and glycolytic enzymes (β-enolase and triosephosphate isomerase). The antioxidant proteins minimize oxidation of lipids and proteins in muscle matrix, whereas the glycolytic enzymes generate NADPH, which helps maintain the antioxidant proteins in their reduced forms.

Conclusion

The strong antioxidant protection offered by vitamin E could have possibly led to less expression of antioxidant proteins as well as glycolytic enzymes that generate antioxidant metabolites in the VITE group, whereas the lack of such protection in CONT group may have led to increased expression of these proteins in the skeletal muscles.