LIPID AND COLOR STABILITY OF HANWOO BEEF WITH THE DIETARY SULFUR AND VITAMIN E SUPPLEMENTATION DURING STORAGE

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Introduction

The lipid and color stability of beef is an important factor affecting meat quality during storage. Lipid oxidation is one of primary causes of loss of quality in meat during storage with, particularly after cooking, the production of off-flavors (Renerre, 2000). Myoglobin (Mb) is the primary pigment responsible for the color of meat and the brown color created by changes due to oxidation of the iron in the heme moiety of Mb and conversion of oxymyoglobin (OxyMb) to metmyoglobin (MetMb) is considered undesirable by most consumers (Smith et al., 2000). The dietary vitamin E (Vit E) supplementation has well known to improve lipid and color stability during storage. Both lipid and Mb oxidations imply with free radicals. Decker et al. (2000) described that free radicals in skeletal muscle are generated in both lipid and cytosolic environments, and tocopherols are lipid-soluble free radical scavengers (FRS). Therefore, it will be more effective if the supplementation of Vit E in diet is accompanied by the supplementation of cytosolic skeletal muscle FRS compound such as thiols /sulfhydryls. The supplementation of sulfur (S) for ruminants can be provided as an inorganic because the rumen bacteria are capable of *de novo* synthesis of S-containing amino acids (Larvor, 1983). This study was carried out to investigate the effects of the dietary S and Vit E supplementation on the lipid and color stability of Hanwoo beef during refrigerated storage.

Materials and Methods

Fifteen heads of 29 months aged Hanwoo bulls were randomly divided into three groups of feed supplementation (S: n=5, Vit E: n=5, and S + Vit E: n=5). S (S≥95%, Bio Tech Co., Korea) was given as much as 12 g/head/day and Vit E (α-tocopherol 33.3% + α-tocopherol acetate 66.7%, Vixxol Co., Korea) was given as much as 1,200 IU/head/day; both supplements were given for 3 months prior to slaughter. Without supplementation, cattle consumed 200 IU/head/day of Vit E from their common diet. Part of the *M. longissimus* from each carcass was cut into 1 cm of thickness and individually packaged in low density polyethylene zipper bags (Cleanwrap Co., Ltd., Korea) and stored in refrigerator (CAG17DZ, LG, Korea) at 4±0.2°C for 10 days. The TBARS value was performed as a described by Sinnhuber and Yu (1977) with slightly modification. The relative Mb concentration at the surface of meat was measured as described by Krzywicki (1979) using reflectance at 473, 525, 572 and 730 nm. Reflectance readings were converted to 2-log (% reflectance) and used in the equation as described by Demos et al. (1996). Reflectance at selected wavelengths was measured using a dual beam spectrophotometer (UV-2401PC, Shimadzu Co., Japan). Data was analyzed using the General Linear Model procedure of SAS Institute (1999).

Results and Discussion

At 5 days of storage the TBARS value of meat from cattle with S + Vit E supplementation was significantly lower (P<0.05) than that with S or Vit E; and at 10 days of storage the TBARS value of meat from cattle with Vit E and S + vit E supplementations was significantly lower (P<0.05) than that with S (Figure 1). At 5 days of storage, MetMb concentration of meat from cattle with S + Vit E supplementation was significantly lower (P<0.05) than that with Vit E. At 10 days of storage, MetMb concentration of meat from cattle with S + Vit E supplementation was significantly lower (P<0.05) than that with S; in turn, that with S was significantly lower (P<0.05) than that with Vit E (Figure 1). These results indicated that the dietary Vit E supplementation has the better effect on the lipid stability whereas S supplementation has the better effect on the OxyMb stability and the dietary combination S and Vit E supplementation has the better effect on the OxyMb stability than S or Vit E. Sulfhydryls, as cytosolic soluble FRS, have the direct effect on the OxyMb stability whereas tochoperols, as lipid soluble FRS, have indirect effect on that. Faustman and Wang (2000) suggested that α–tocopherol delays the release of prooxidative products of lipid oxidation from biomembranes, which in turn delays OxyMb oxidation.

At 10 days of storage, the redness (a^*) value of meat from cattle with S supplementation was significantly higher (P<0.05) than that with Vit E and the hue-angle (h^o)value of meat from cattle with S and S + Vit E supplementations was significantly lower (P<0.05) than that with Vit E (Figure 2). This may due to the difference MetMb concentration among them. Renerre (2000) stated the decrease redness value follows the accumulation of MetMb during oxidation and the increase in hue-angle value indicates the degree of change from redness to yellowness.

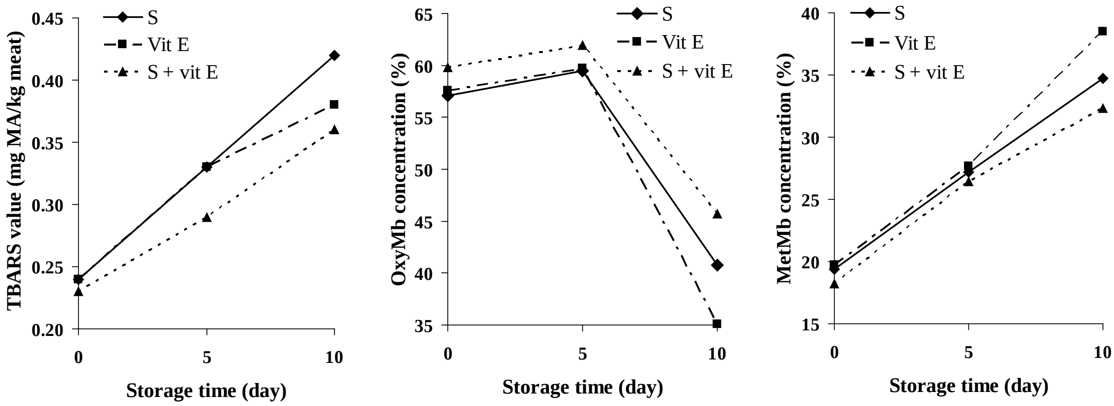

Figure 1. The TBARS value and the relative Mb concentration of *M. longissimus* from Hanwoo (Korean cattle) with different feed supplementation during refrigerated storage.

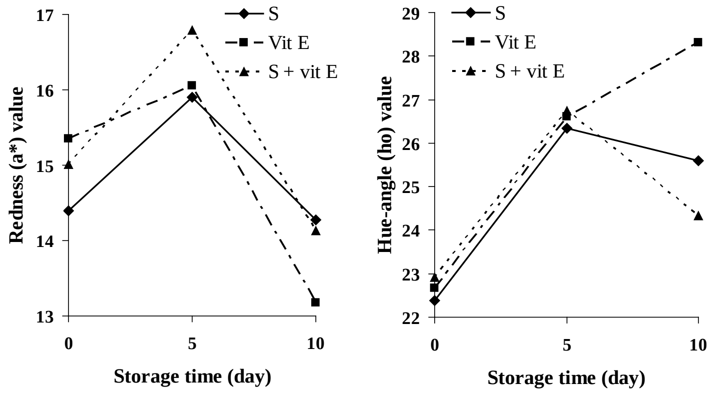

Figure 2. The redness (a*) and hue-angle (h^{o}) values of *M. longissimus* from Hanwoo (Korean cattle) with different feed supplementation during refrigerated storage.

Conclusions

The dietary Vit E supplementation has the better effect on the lipid stability, whereas S supplementation has the better effect on the OxyMb and the dietary combination S and Vit E created the hurdle protection for beef from OxyMb oxidations so that improved the color stability of meat during refrigerated storage.

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