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Effect of Dietary *Rhus verniciflua* Stokes on the Water Holding Capacity, Color Stability, and Lipid Oxidation of Hanwoo (Korean Cattle) Beef during Cold Storage after Thawing

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Introduction

Natural antioxidants may have applications in the food industry and there is some evidence that these substances may carry over an antioxidant effect within the human body after consumption(1). *Rhus verniciflua* Stokes (RVS) has long been used as a food additive in Korea(3). Antioxidant potential of RVS is closely associated with polyphenolic compounds such as fustin, quercetin, butein, and sulfuretin, thereby suggesting that flavonoids are the major active compounds responsible for the biological activity of RVS(6). Recently we studied the effect of dietary RVS-supplemented on the quality of Hanwoo (Korean cattle) steer beef(7). We found that RVS-supplemented Hanwoo (Korean cattle) beef effective in increasing color stability, water holding capacity (WHC), unsaturated fatty acid and retarding lipid oxidation than the control during refrigerated storage. Therefore, this study was carried out to investigate the effect of dietary RVS on the WHC, color stability, and lipid oxidation of Hanwoo (Korean cattle) beef during cold storage after thawing.

Materials and methods

4 groups (3 head/group) of 22 months old-Hanwoo (Korean cattle) steers were fed a common basal diet with 0 (control), 2 (T1), 4 (T2), and 6% (T3) RVS for 4 months prior to slaughter.

Semimembranosus muscles from 12 carcasses were vacuum-packaged in polyethylene bags and stored at -20℃ for 9 months. Following thawed, samples were cut into 3 cm and individually packaged in LDPE zipper bags (Clean zipper bag, Cleanwrap Co., LTD, Korea), placed in dark room at 4℃ for 7 days. The drip loss was determined according to a method of Honikel[4] and expressed as percentage of the initial weight. Color of the sample surface was measured by a Chroma meter (CR-301, Minolta Co., Japan), which recorded the lightness (L^*), redness (a^*), yellowness (b^*) and hue-angle (h^o) was obtained from a^* and b^* by formula : $h^o=\tan^{-1}(b^*/a^*)$. The TBARS (2-thiobarbituric acid reactive substances) value was determined as described by Sinnhuber and Yu[9] and reported as mg malonaldehyde (MA)/kg sample. The relative concentration of metmyoglobin (metMb) at the sample surface was measured as described by Kryzwicki[5] using reflectance at 525, 572, and 730nm. Reflectance readings were converted to absorbance [2-log (% reflectance)] as described by Demos et al.[2]. R_{630}/R_{580} value, indicator of redness, was determined as described by Strange et al.[10] using reflectance at 580 and 630nm. Data was analyzed using the General Linear Model procedure of SAS[8] program. Differences between means at the 5% level were determined by the Duncan's multiple range tests.

Results and discussion

Drip loss

The drip loss (Fig. 1) of day 1 was significantly lower in T2 than in the control ($P<0.05$). It of day 2 was significantly lower in RVS treatments than in the control($P<0.05$) but it was significantly lower in T2 and T3 than in the control after 5 days ($P<0.05$). In addition, the drip loss of T2 was significantly increased after 5 days ($P<0.05$) but the drip losses of control, T1, and T3 were significantly increased after 2 days ($P<0.05$).

Surface meat color

The lightness (L^*) (Fig. 2) was significantly higher in the control than RVS treatments after 2 days ($P<0.05$). It was not significantly different among the control and T2 during storage days. The lightness (L^*) of T1 and T3 were significantly decreased in day 2 and day 5 ($P<0.05$) and not significantly different later. The redness (a^*) (Fig. 3) of day 0 was significantly higher in RVS treatments than in the control ($P<0.05$) and it was significantly higher in T3 and T4 than in the control after 2 days ($P<0.05$). The yellowness (b^*) (Fig. 4) of day 0 was significantly higher in the control than in T3 ($P<0.05$) but it of day 2 was significantly higher in T2 than in T3 ($P<0.05$). And it of day 7 was significantly higher in T2 than in the control ($P<0.05$). The hue-angle (h^o) (Fig. 5) of day 0 was significantly higher in the control than in T3 ($P<0.05$) and it was significantly higher in the control than in T2 and T3 after 2 days ($P<0.05$).

Lipid oxidation, surface metMb concentration, and R630/R580 value

The TBARS value (Fig. 6) was significantly lower in T2 and T3 than in control during storage days ($P<0.05$) and it was significantly lower in T2 than in T3 after 5 days ($P<0.05$). The surface metMb concentration (Fig. 7) was significantly lower in RVS treatments than in the control during storage days ($P<0.05$) and it of day 7 was significantly in T2 than in the other treatments ($P<0.05$). The R_{630}/R_{580} value, indicator of redness[10], was significantly higher in RVS treatments than in the control during storage days ($P<0.05$). It was significantly higher in T3 than in the other treatments after 2 days ($P<0.05$) but it of day 7 was significantly higher in T2 than in the other treatments ($P<0.05$).

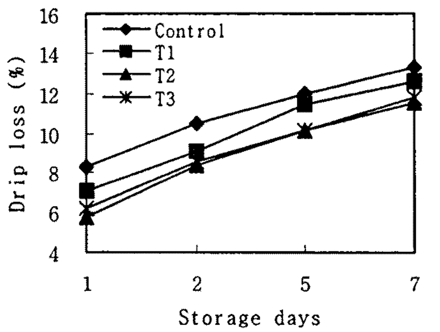

Fig. 1. Effect of dietary RVS on the drip loss of Hanwoo (Korean cattle) beef during cold storage after thawing.

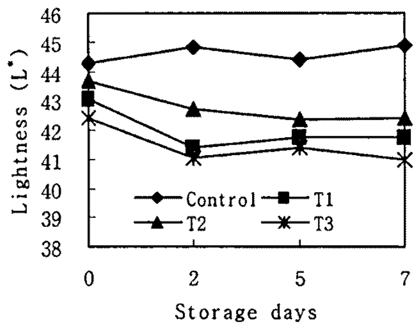

Fig. 2. Effect of dietary RVS on the lightness of Hanwoo (Korean cattle) beef during cold storage after thawing.

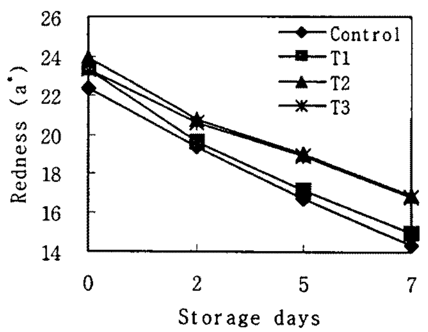

Fig. 3. Effect of dietary RVS on the redness of Hanwoo (Korean cattle) beef during cold storage after thawing.

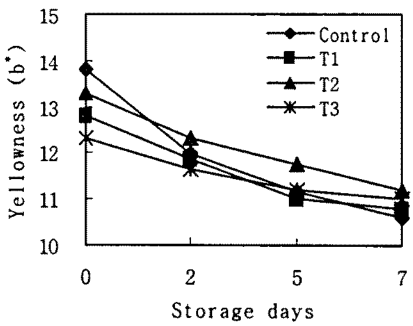

Fig. 4. Effect of dietary RVS on the yellowness of Hanwoo (Korean cattle) beef during cold storage after thawing.

Summary

This study was carried out to investigate the effect of dietary RVS on the WHC, color stability, and lipid oxidation of Hanwoo (Korean cattle) beef during cold storage after thawing. RVS fed Hanwoo (Korean cattle) beef was more effective in increasing WHC, color stability and delaying lipid oxidation than that without RVS in diet. And 4% RVS fed Hanwoo (Korean cattle) beef showed the greatest effects.

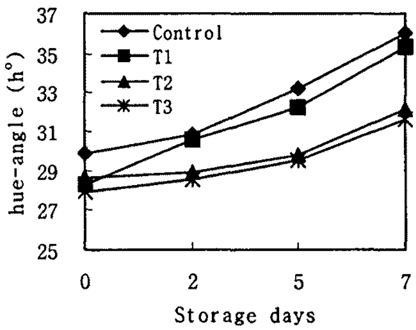

Fig. 5. Effect of dietary RVS on the hue-angle of Hanwoo (Korean cattle) beef during cold storage after thawing.

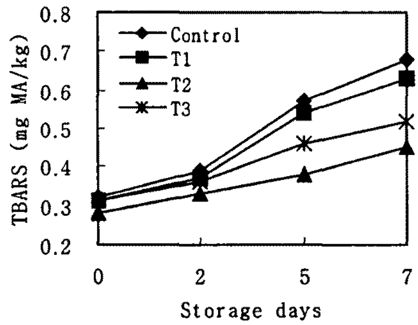

Fig. 6. Effect of dietary RVS on the TBARS value of Hanwoo (Korean cattle) beef during cold storage after thawing.

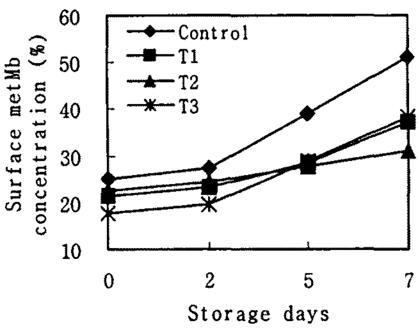

Fig. 7. Effect of dietary RVS on the surface metMb concentration of Hanwoo (Korean cattle) beef during cold storage after thawing.

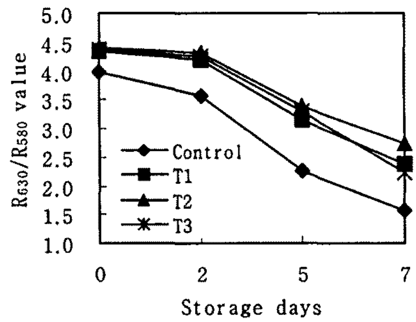

Fig. 8. Effect of dietary RVS on the R630/R580 value of Hanwoo (Korean cattle) beef during cold storage after thawing.

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