Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 1 *Cattleman's Day (1993-2014)*

Article 636

1995

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Recommended Citation

Lavelle, C.L.; Hunt, Melvin C.; and Kropf, Donald H. (1995) "Display life and internal cooked color of ground beef from vitamin e-supplemented cattle (1995)," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 1. https://doi.org/10.4148/2378-5977.2039

DISPLAY LIFE AND INTERNAL COOKED COLOR OF GROUND BEEF FROM VITAMIN E-SUPPLEMENTED CATTLE [1]

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Summary

Retail display life of ground beef and internal color of patties cooked to four endpoint temperatures (131, 149, 160, and 171°F) were determined for ground beef (9% fat) from vitamin E-supplemented (500 and 2000 IU per day) steers. Visual scores indicated that the display time required for the 500 and 2000 vitamin E samples to reach an objectionable reddish-brown/brown color was increased by 12 and 32 hours, respectively, as compared with the 0 vitamin E samples. Patties did not differ in internal cooked color regardless of vitamin E level. Vitamin E was effective in increasing retail display color stability and did not affect cooked color.

(Key Words: Visual Display, Cooked Color, Vitamin E, Ground Beef, Color.)

Introduction

Displaying meat cuts under high intensity lights, such as those found in retail cases, accelerates the formation of an undesirable brown, metmyoglobin color. Every year, retailers lose an estimated $1.1 billion from discoloration of meat cuts prior to microbiological spoilage. Cuts from vitamin E-supplemented cattle have a longer retail display life than cuts from nonsupplemented cattle. The effect of vitamin E supplementation on the internal cooked color of beef is not known. Our objectives in this research were to determine the effects of vitamin E supplementation on ground beef retail color stability and on cooked color development.

Experimental Procedures

Knuckles representing two replications of 18 Holstein steers each were obtained from the University of Wisconsin-Madison. For each replication, six steers received no supplemental vitamin E, six received 500 IU, and six received 2000 IU daily for approximately 120 days prior to slaughter. The meat was fabricated, vacuum packaged, shipped fresh to Kansas State University by Packerland (Green Bay, WI), and stored at 35°F until 17 days postslaughter. Coarsely ground lean was mixed with trimmed fat to achieve 9% fat and re-ground through a 1/8-inch plate. Samples for visual appraisal were removed, and the remainder of the meat was formed into patties, frozen, vacuum packaged, and stored at -4°F until used.

For visual display, 3/4-lb packages were wrapped with oxygen-permeable film and arranged in a 32-36°F commercial, open topped, display cabinet programmed for one daily defrost cycle. Samples were displayed continuously under 150 footcandles of Phillips 40 watt DLX warm white fluorescent lights. Average CIE a* values were measured at 0, 16, 23, 44, 68 and 92 hours, and samples also were scored by six trained panelists using a 5-point scale (1=bright red, 2=red, 3=reddish-brown, 4=moderately brown, 5=very brown).

For cooked color, frozen patties were thawed and cooked on an electric griddle (325°F) to internal temperatures of 131, 149, 160, or 171°F. After cooking, average internal CIE Lab values were measured, and the internal

[1]The authors wish to thank Kristine Scheller and Qingping Liu at the University of Wisconsin-Madison for performing the vitamin E analyses.

color was ranked subjectively to the nearest .5 on a 5-point color scale by one panelist.

Raw patties were analyzed for pH and fat oxidation (TBA) . Whole muscle samples taken prior to grinding were measured for α-tocopherol content. Data were analyzed as split-plots with differences among means being determined using least square means.

Results and Discussion

Vitamin E level did not consistently affect pH (Table 1). Increasing the level of vitamin E decreased TBA values (Table 1), and vitamin E levels reflected vitamin E intakes. Vitamin E level had no effect (P>.05) on the internal cooked color of patties (results not shown).

Vitamin E affected (P<.05) visual scores for display color stability, with differences between levels being detected by 16 hours (Figure 1). Those differences persisted through 92 hours (P<.05). At each time interval, lower scores (i.e., more redness) were recorded for the 2000 E samples followed by the 500 E and 0 E samples. Considering a visual score of 3.5 as unsalable, the 0 E samples were salable for 48 hours, the 500 E samples for 60 hours, and the 2000 E samples for 80 hours. Instrumental a* values were similar (P>.05) for all three levels of vitamin E at 0 and 16 hours (Table 1). By 23 hours, the 500 and 2000 E samples had higher (P<.05) a* values than the 0 E samples, and the differences persisted (P ≤.05) throughout display (Table 1). The retail display life extension seen for the vitamin E samples in this study is less than that previously reported. Differences could be attributed to the amount of vitamin E in the muscle, retail case temperature, defrost cycles, or light intensity. These data indicate that beef from vitamin E-supplemented cattle retained a redder color longer than that from cattle without supplemental vitamin E.

Table 1. Characteristics[d] of Ground Beef with and without Vitamin E

	Vitamin E Supplementation, IU		
Trait	0	500	2000
Raw patty pH	5.63[a,b]	5.65[a]	5.62[b]
TBA value , μg TBA reactive/g sample	1.3[a]	.8[b]	.5[c]
α-tocopherol , μg/g fresh meat	1.22[a]	2.43[b]	5.31[c]
a* value (redness)			
0 hour	37.6	39.8	39.0
16 hour	29.5	32.5	31.7
23 hour	26.4[a]	30.9[b]	30.5[b]
44 hour	20.5[a]	25.6[b]	26.1[b]
68 hour	14.4[a]	19.7[b]	20.7[b]
92 hour	10.9[a]	15.1[b]	17.4[b]

[a,b,c]Means within a row with the same superscript letter are not different (P>.05).
[d]Data were pooled for replication.

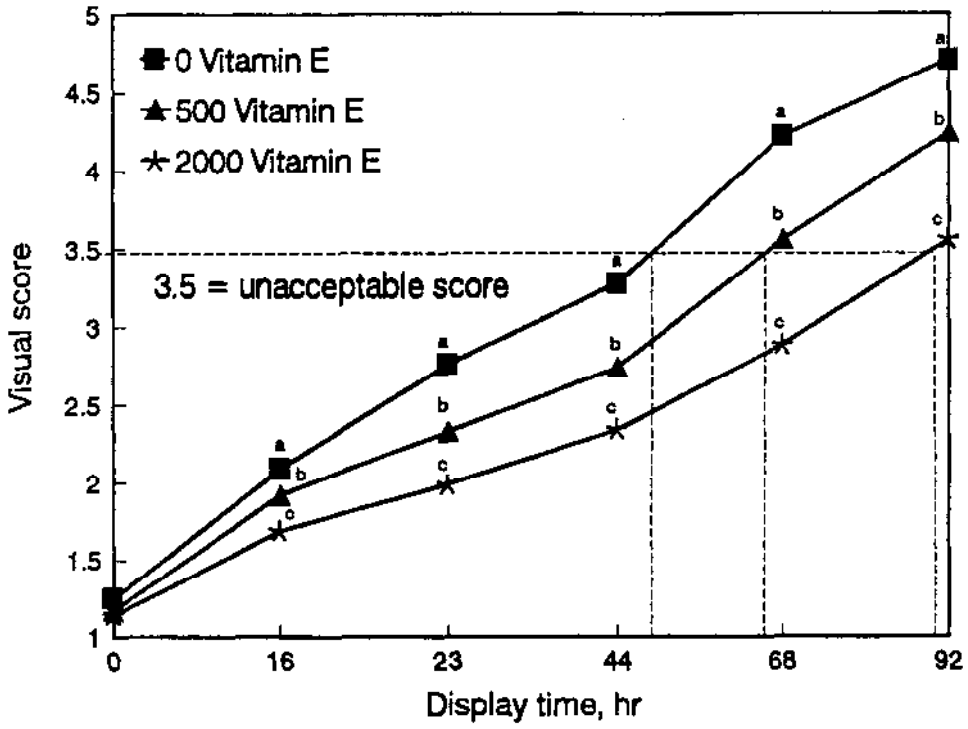

Figure 1. **Effect of Vitamin E on Visual Color Score of Ground Beef during Lighted Display at 32°F. Visual score: l=bright red, 2=red 3=reddish-brown, 4= moderately brown, 5=very brown. Data points within each hour with a different letter are different (P<.05)**