EFFECTS OF TEA POLYPHENOLS AND GRAPE SEED EXTRACTS ON THE PREMATURE BROWNING OF BEEF PATTIES IN DIFFERENT PACKAGES

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I. OBJECTIVES

Premature browning (PMB) is a cooked color problem for ground beef that can occur at internal temperatures below 71°C. The denaturation of myoglobin results in a tan color, and it causes consumer misjudgment on the endpoint of beef cooking, which may result in food safety problems. Studies have found that some natural antioxidants can inhibit PMB. Therefore, the objective of this study was to investigate the effect of tea polyphenols (TP) and grape seed extracts (GSE) in inhibiting or minimizing PMB in beef patties combined with different packages.

II. MATERIALS AND METHODS

The ground beef (15% fat + 85% lean) was divided into 4 groups: (1) Control group, (2) 0.1 g/kg TP group, (3) 0.1 g/kg GSE group, and (4) 0.1 g/kg TP + 0.1 g/kg GSE combined group. Each natural antioxidant was dissolved together with 2% salt in 10% water, added to the ground beef, mixed well, and chopped for 15 s before making patties. A total of 27 patties of each group were randomly divided into 3 groups and packaged in aerobic packaging (AP), high-oxygen packaging (HiOx-MAP, 80% O_2/20% CO_2), and vacuum skin packaging (VSP), respectively, and then stored at 4°C for 0 d, 3 d, and 6 d. The patties were cooked to a central temperature of 66°C, and then immediately removed and placed in ice bath for 5 min in a bag to prevent the temperature from rising. The center color was recorded using a X-Rite spectrometer (CR400, Konicamino, Japan). The experiments were performed in duplicate. The data were analyzed using a MIXED model (SAS version 9.0; SAS Institute Inc., Cary, NC) with natural antioxidation, package, storage time, and the interaction as fixed factors.

Table 1. Effects of tea polyphenol and grape seed extract, storage time, and package on cooked color of a* value of beef patties cooked to 66°C

		Storage time (d)		
Natural antioxidant	Packaging	0	3	6
Control	AP	10.98 ± 0.45^{axm}	8.96 ± 0.24^{byn}	9.01 ± 0.14^{byn}
	HiOx-MAP	10.98 ± 0.45^{axm}	9.30 ± 0.43^{ayn}	8.37 ± 0.12^{azn}
	VSP	10.98 ± 0.45^{axn}	11.80 ± 0.70^{bxn}	13.80 ± 0.49^{axm}
TP	AP	11.12 ± 0.37^{axm}	9.14 ± 0.25^{abyn}	10.59 ± 0.11^{aym}
	HiOx-MAP	11.12 ± 0.37^{axm}	9.79 ± 0.05^{ayn}	8.91 ± 0.17^{azn}
	VSP	11.12 ± 0.37^{axn}	13.00 ± 0.15^{axm}	13.77 ± 0.17^{axm}
GSE	AP	11.18 ± 0.21^{axm}	9.72 ± 0.23^{abyn}	10.48 ± 0.24^{aymn}
	HiOx-MAP	11.18 ± 0.21^{axm}	9.76 ± 0.18^{ayn}	9.03 ± 0.27^{azn}
	VSP	11.18 ± 0.17^{axo}	13.28 ± 0.21^{axm}	12.87 ± 0.52^{abxn}
TP and GSE	AP	11.36 ± 0.53^{axm}	9.99 ± 0.16^{ayn}	10.77 ± 0.07^{aymn}
	HiOx-MAP	11.36 ± 0.53^{axm}	9.84 ± 0.26^{ayn}	9.09 ± 0.10^{azn}
	VSP	11.36 ± 1.14^{axn}	13.04 ± 0.53^{axm}	12.71 ± 0.15^{bxm}

- [a–d]Mean differences at same package and storage time among different natural antioxidants ($P < 0.05$).
- [x–z]Mean differences at same storage time and natural antioxidant among different packages ($P < 0.05$).
- [m–n]Mean differences at same package and natural antioxidant among different storage times ($P < 0.05$).
- AP, aerobic packaging; GSE, grape seed extract; HiOx-MAP, high-oxygen packaging; TP, tea polyphenols; VSP, vacuum skin packaging.

III. RESULTS

Lower *a** value means less redness and more browning. Sensory evaluation found that browning was observed when the *a** value reached 9 in this study. The browning of beef patties in the HiOx-MAP was the greatest on day 6 when cooked to 66°C in each treatment. TP and GSE alone or in combination inhibited PMB in patties stored under AP, but they were ineffective under HiOx-MAP. VSP had the best effect on PMB inhibiting (Table 1).

IV. CONCLUSION

HiOx-MAP can cause more PMB for beef patties, while VSP can inhibit PMB. The addition of TP or GSE can minimize PMB for beef patties in the AP but has no effect in the HiOx-MAP.

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Keywords: beef patty, natural antioxidant, package, premature browning