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ANTIOXIDANT EFFECTS OF RAISIN PASTE IN COOKED GROUND BEEF AND PORK

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Introduction

Raisins are recognized as a good source of dietary antioxidants. Grapes and raisins contain various antioxidant compounds, including bioflavanoids (Shalashvili et al., 2002) and proanthocyanidins (Murga et al., 2000). Lipid oxidation (warmed over flavor) limits the shelf life and acceptability of cooked meat items (Jayasingh and Cornforth, 2002). Although raisins contain antioxidant compounds, their possible antioxidant effectiveness in cooked meat systems has not been previously studied.

Objectives

To study the possible antioxidant effects of raisin paste in cooked ground beef or pork.

Methodology

Sample Preparation: Ground beef (15% fat), lean ground pork shoulder (20% fat) and whole dark raisins were purchased from local supermarkets. Raisin paste was prepared by blending 60 g raisin with 20 ml distilled water for 1 min. in an Osterizer blender (Sunbeam Products, Inc. Boca Raton, FL). The raisin paste was manually mixed with ground beef (400 g) at 0.5, 1.0, 1.5 and 2.0% of meat weight respectively. The raisin paste was manually mixed with ground pork (400 g) at 1.0, 2.0, 3.0 and 4.0% of meat weight respectively. The ground meats were thoroughly cooked to well done state on a grill at a temperature setting of 163°C. A small amount of water was added during cooking to prevent sticking and charring. After cooking, the ground meats were divided into 4 equal portions and were placed in sealable (Ziploc) bags and cooled for 10 min. at room temperature. Bags were then sealed and stored at 2°C for 1, 4, 7 or 14 days.

TBA Test: Thiobarbituric acid reactive substances (TBARS) values were measured on duplicate 10 g samples by the distillation method of Tarladgis et al. (1960) at each storage period (1, 4, 7 or 14 days).

Sensory Evaluation: A trained panel (n=6) evaluated cooked samples at 1, 4, 7 and 14 days of refrigerated storage. Panelists were selected based on their sensitivity and reproducibility for detection of rancid samples (TBA Value > 1.5) in preliminary tests. The panelists evaluated cooked samples for cooked beef or pork flavor intensity, rancid flavor intensity and raisin flavor intensity on a scale of 1 to 5 where 1 = no detectable

flavor, 2 = slightly intense flavor, 3 = moderately intense flavor, 4 = very intense flavor and 5 = extremely intense flavor respectively.

Experimental Design: For beef and pork the experiment was done in 3 or 2 separate replicates, respectively (3 or 2 separate two-week test intervals, respectively). Analysis of variance (ANOVA) was done on the data sets. Treatment means were compared by the least significance difference (LSD) test. Significance was accepted at $p < 0.05$.

Results & Discussion

Cooked Ground Beef

TBA values were significantly ($p < 0.05$) reduced by addition of raisin paste to ground beef before cooking (Table 1). The mean TBA values (pooled over storage times) for the various treatments are shown in Table 2. TBA values increased significantly ($p < 0.05$) with storage time after cooking (Table 2).

The interaction of raisin content X storage time also significantly ($p < 0.05$) affected TBA values (Table 3). The control samples without raisins increased to a TBA value of 6.81 after 14 days storage at 2°C. In general TBA values > 1.4 are associated with detectable rancid odor and flavor (Jayasingh and Cornforth, 2003).

The trained panel sensory scores for rancid odor / flavor were in good agreement with the TBA values. Panelists (n=6) unanimously rated control samples (without added raisin paste) with scores > 3.0, where 3.0 = moderately intense rancid flavor. The panelists did not detect raisin flavor even at the highest level (2.0% of added raisin). 2.0% raisin was sufficient to prevent detection of rancid flavor for 14 days, in cooked ground beef.

Cooked Ground Pork

Preliminary experiments established that cooked ground pork was more susceptible to lipid oxidation, with development of higher TBA values than observed in cooked ground beef samples. Thus, higher levels (up to 4%) of raisin paste were evaluated for possible inhibition of rancidity. The main effects of treatment and storage time affected TBA values of cooked ground pork (Tables 4,5). The interaction effects of treatment X storage time on cooked ground pork samples are shown in table 6.

Similar to cooked ground beef, the panelists noted an increase in rancid odor and flavor of control samples stored for 14 days at 2°C. Raisin paste at 2–4% levels significantly ($p < 0.05$) reduced the perception of rancidity.

Conclusions

The addition of raisin paste was highly effective in reducing lipid oxidation and the perception of rancidity in cooked ground beef and pork. 2.0% raisin paste was adequate for prevention of rancidity in cooked ground beef. 2–4% raisin paste was found to be adequate for significant ($p < 0.05$) reduction of TBA values and rancid flavor in cooked ground pork.

References

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Tables and Figures

Table 1: Mean TBA values for the treatment main effects pooled over storage time (n=24). Means with the same letter are not different ($p < 0.05$).

Treatment	TBA value
Control	4.63 a
0.5% raisin	2.47 b
1.0% raisin	1.48 c
1.5% raisin	1.21 cd
2.0% raisin	0.84 d

Table 2: Mean TBA values for the storage time main effects pooled among treatments (n=30). Means with the same letter are not different ($p < 0.05$).

Storage Days	TBA value
1	1.29 c
4	1.93 bc
7	2.36 ab
14	2.93 a

Table 3. Interaction effects of treatment X storage time on TBA values (n=6) of cooked ground beef formulated with raisin paste (0, 0.5, 1.0, 1.5, 2.0% of meat weight).

Treatment	Storage Days @ 2°C	Mean TBA Value
Control	1	2.43 ef
Control	4	4.13 c
Control	7	5.16 b
Control	14	6.81 a
0.5% Raisin	1	1.45 hi
0.5% Raisin	4	2.34 ef
0.5% Raisin	7	2.77 e
0.5% Raisin	14	3.34 d
1.0% Raisin	1	1.00 ik
1.0% Raisin	4	1.21 hij
1.0% Raisin	7	1.66 gh
1.0% Raisin	14	2.05 fg
1.5% Raisin	1	0.88 jk
1.5% Raisin	4	1.16 ijk
1.5% Raisin	7	1.32 hij
1.5% Raisin	14	1.48 hi
2.0% Raisin	1	0.70 k
2.0% Raisin	4	0.81 jk
2.0% Raisin	7	0.88 jk
2.0% Raisin	14	0.97 ijk

a – k means with the same letter are not different ($p < 0.05$).
Least significant difference among means ($LSD_{0.05}$) = 0.50.

Table 4: Mean TBA values for the treatment main effects pooled over storage time (n=16). Means with the same letter are not different ($p < 0.05$).

Treatment	TBA value
Control	12.79 a
1.0% raisin	6.48 b
2.0% raisin	3.59 c
3.0% raisin	2.63 c
4.0% raisin	2.51 c

Table 5: Mean TBA values for the storage time main effects pooled among treatments (n=20). Means with the same letter are not different ($p < 0.05$).

Storage Days	TBA value
1	3.05 b
4	5.19 ab
7	6.87 a
14	7.28 a

Table 6. Interaction effects of treatment X storage time on TBA values (n=4) of cooked ground pork formulated with raisin paste (0, 1, 2, 3, 4 % of meat weight).

Treatment	Storage Days @ 2°C	Mean TBA Value
Control	1	8.37 c
Control	4	11.84 b
Control	7	15.17 a
Control	14	15.77 a
1.0% Raisin	1	2.64 ef
1.0% Raisin	4	6.53 cd
1.0% Raisin	7	7.84 c
1.0% Raisin	14	8.90 c
2.0% Raisin	1	1.63 fg
2.0% Raisin	4	3.32 efg
2.0% Raisin	7	4.47 def
2.0% Raisin	14	4.93 de
3.0% Raisin	1	1.03 g
3.0% Raisin	4	2.08 fg
3.0% Raisin	7	3.80 defg
3.0% Raisin	14	3.60 efg
4.0% Raisin	1	1.61 fg
4.0% Raisin	4	2.16 efg
4.0% Raisin	7	3.04 efg
4.0% Raisin	14	3.22 efg

Means with the same letter are not different ($p < 0.05$).
Least significant difference among means (LSD0.05) = 2.79