EFFECT OF GREEN TEA AND GRAPE SEED EXTRACTS ON PRECOOKED PORK MEATBALLS.

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Introduction

With the increasing interest in ready-to-eat products, precooked meats become a concern as these are susceptible to colour changes, lipid oxidation and microbial contamination, important factors influencing quality and acceptability of meat and meat products (Hunt et al, 1999; Ahn et al 2007). For cooked meat, thermal processes can promote lipid oxidation by disrupting cell membranes and releasing prooxidants inducing WOF during refrigerate storage and posterior reheating. Currently, exogenous antioxidants such as phenolic compounds plant derivatives and chelating agents are added to raw or cooked meat products to improve oxidative stability (Jo et al, 2003). Sodium ascorbate is widely used in meat industry due to its preservative properties. The use of natural antioxidants, tea catechins extracts in cooked beef, pork, poultry and fish (Tang et al, 2001) and grape seed extracts in turkey meat (Mielnik et al 2006), delayed lipid oxidation. Prediction of antioxidative activity is very difficult and the different extracts should be always tested in each meat product. The objective of this study was to determine the effects of natural antioxidants (green tea and grape seed extracts) compared with sodium ascorbate during storage on lipid oxidation, colour and sensory attributes of precooked meatballs.

Materials and Methods

Experimental design: Four groups of pork meatballs were manufactured using pork meat (70% lean, 30 % fat), ClNa (2.0%) and liquid whole egg (12%). Sodium ascorbate (400 mg sodium ascorbate kg^{-1}) SA**,** grape seed extract (300 mg watery grape seed extract kg^{-1}) GSE and green tea catechins extracts (300 mg watery green tea extract kg^{-1}) GTE were added to each group. Control meatballs C, were prepared without antioxidants. Meat temperature during processing did not exceed 12 ºC. Meatballs were manual formed and fried during 5 min in vegetal oil at 180 ºC. Fried meatballs were stored to 4ºC during 0, 4, 8, 12 and 16 days, simulating retail display conditions. CIELAB colour, TBARs, Volatile compounds and COPs were analysed. *Measurements of lipid oxidation:* TBARs, Botsoglou et al (1994); Volatile compounds**,** Brunton et al (2001). Extraction of headspace volatiles by solid phase (SPME) with a Carboxen-PDMS fiber 75 µm was made. Absorption and desorption times were set at 30 and 3 min, in splitless mode for separation in a GC equipped with a FID and capillary column. Cholesterol compounds, Park and Addis (1986). Separation of cholesterol oxides was made by a previous SPE extraction, derivatization treatment and analysed by GC with FID and capillary column. CIELAB (Minolta chromameter II CR-200). *Sensory attributes- Reheating meatballs:* The sensory attributes were evaluated day 0 by a semitrained panel formed by eight persons chosen from the university community. The whole meatballs packed separately in PE bags were reheated in microwave to reach the centre temperature to 70 ºC maintained in a sand bath and presented one at time to panellists at 60ºC. *Statistical model:* Extract and storage day effects were analysed by ANOVA (Scheffe means Test). The computer statistics program used was Statistix 8.0 for Windows (Analytical Software, New York, USA).

Results and Discussion

Antioxidant effect of ascorbate, tea and grape polyphenols on meat lipids has been reported by several authors (Tang et al., 2001; Jo et al., 2003; Nissen et al., 2004; Mielnik et al., 2006). Table1 shows the effect of extract and storage day on TBARs and COPs in the precooked pork meatballs. Significant differences ($P<0.05$) in TBARS and COPs values between C and SA-SGE-GTE (every day of control) and between SA and SGE-GTE (day 4, 8, 12, 16) were found. TBARS and COPs increased strongly throughout storage in C and SA. Hexanal was the most abundant volatile compounds in cooked samples (Table 2). SA, GTE and GSE showed lower total volatiles values compared to C during all refrigerated storage time; the effectiveness of antioxidants was GTE>GSE>SA. Colour values are shown in Figure 1, 2, 3. Lightness increases with storage time. L values showed differences ($P<0,05$) between C and SA, related to GTE and GSE (Fernández López et al, 2005). Redness decreased in all the samples except SA in which a* values are similar during storage time. The extracts studied GTE and GSE no affected meatballs sensory attributes (no off odour and off flavour were found).

Conclusions

The results of this study indicated that addition of green tea catechins or grape seed extracts prior to precooking meatballs reduces lipid oxidation (TBARs, volatile compounds and COPs) significantly compared to control samples. Sodium ascorbate showed antioxidant effect lower than extracts but the highest colour stability. Meatballs sensory quality was no affected by the addition of these natural antioxidants.

References

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Table 1. Means and standards deviation TBARs and COPs values in precooked pork meatballs stored under retail display conditions made with different antioxidants.

Day		C	SA	GTE	GSE
0	TBARs	0.562 ± 0.187 ^{a,v}	0.167 ± 0.173 ^{b,x}	0.067 ± 0.012 ^{b,v}	0.091 ± 0.018 ^{b,v}
	COPs	0.482 ± 0.118 ^{a,z}	0.095 ± 0.005 ^{b,z}	0.098 ± 0.016 ^{b}	0.602 ± 0.082 ^{a,x}
4	TBARs	3.402 ± 0.257 ^{a,z}	1.077 ± 0.054 ^{b,y}	0.233 ± 0.023 ^{c,y}	0.262 ± 0.019 ^{c,y}
	COPs	1.107 ± 0.206 ^{a,y}	0.409 ± 0.038 ^{c,y}	0.128 ± 0.010 ^{d}	0.680 ± 0.104 ^{b,x}
8	TBARs	4.420 ± 0.468 ^{a,y,z}	2.138 ± 0.054 ^{b,z}	0.197 ±0.034 ^{c,y}	0.187 ± 0.005 ^{c,z}
	COPs	0.577 ± 0.400 ^{a,b,y,z,}	0.302 ± 0.026 ^{b,c,y,z}	0.086 ± 0.088 ^{c}	0.772 ± 0.059 ^{a,x}
12	TBARs	4.752 ± 0.462 ^{a,x,y}	2.603 ± 0.112 ^{b,v}	0.353 ±0.036 ^{c,x}	0.388 ± 0.240 ^{c,x}
	COPs	1.914 ± 0.356 ^{a,x}	1.011 ± 0.330 ^{b,x}	0.156 ± 0.060 ^{c}	0.756 ± 0.238 ^{b,x}
16	TBARs	5.462 ± 0.969 ^{a,x}	3.515 ± 0.089 ^{b,t}	0.122 ± 0.030 ^{c,z}	0.215 ± 0.038 ^{c,y,z}
	COPs	1.754 ± 0.416 ^{a,x}	1.101 ± 0.047 ^{b,x}	0.121 ± 0.033 ^{c}	0.279 ± 0.134 ^{c,y}

Means with different superscripts are significantly different (P<0,05)

Table 2. Means and standards deviation Volatiles Compounds values in precooked pork meatballs stored under retail display conditions made with different antioxidants.

Day		C	SA	GTE	GSE
0	2 -Butanona	0.00 ± 0.00 ^{z}	0.00 ± 0.00 ^{y}	0.00 ± 0.00 ^{y}	0.00 ± 0.00 ^{y}
	Hexanal	4.16 ± 0.68 ^{a,y}	2.97 ± 0.44 ^{b,v}	2.73 ± 0.50 ^{b,z}	2.93 ± 0.75 ^{b,y}
	Heptanal	0.47 ± 0.69 ^{z}	0.38 ± 0.36 ^{a,z}	0.02 ± 0.00 ^{a,v}	0.02 ± 0.00 ^{a,y}
	Total Volatiles	4.62 ± 1.05 ^{a,z}	3.34 ± 0.55 ^{a,b,z}	2.75 ± 0.50 ^{b,y}	2.95 ± 0.75 ^{b,y}
4	2 –Butanona	0.04 ± 0.01 ^{a,z}	0.00 ± 0.00 ^{b,y}	0.00 ± 0.00 ^{b,y}	0.03 ± 0.02 ^{a,y}
	Hexanal	12.88 ± 2.48 ^{a,y}	6.78 ± 2.47 ^{b,z,v}	2.21 ± 0.53 ^{c,z}	1.04 ± 0.15 ^{c,z}
	Heptanal	2.44 ± 0.67 ^{a,z}	1.57 ± 0.34 ^{b,y,z}	0.07 ± 0.01 ^{c,z}	0.06 ± 0.00 ^{c,y}
	Total Volatiles	15.37 ± 3.08 ^{a,z}	8.35 ± 2.44 ^{b,z}	2.28 ± 0.52 ^{c,y}	1.13 ± 0.12 ^{c,z}
8	2 –Butanona	2.10 ± 0.55 ^{a,y}	0.87 ± 0.63 ^{b,x}	0.00 ± 0.00 ^{c,y}	0.03 ± 0.02 ^{c,y}
	Hexanal	73.52 ± 6.51 ^{a,x}	23.30 ± 2.27 ^{b,x}	8.32 ± 1.89 ^{c,x}	4.00 ± 0.45 ^{c,x}
	Heptanal	21.07 ± 2.58 ^{a,x}	11.24 ± 4.86 ^{b,x}	0.17 ± 0.01 ^{c,y}	0.21 ± 0.09 ^{c,y}
	Total Volatiles	96.69 ± 4.00 ^{a,x}	35.42 ± 4.10 ^{b,x}	8.49 ± 1.90 ^{c,x}	4.23 ± 0.56 ^{c,x}
12	2 –Butanona	2.27 ± 0.32 ^{a,y}	1.39 ± 0.28 ^{b,x}	0.54 ± 0.14 ^{c,x}	0.07 ± 0.03 ^{d,y}
	Hexanal	66.14 ± 8.57 ^{a,x}	14.04 ± 3.57 ^{b,y}	6.06 ± 0.44 $^{b.c,y}$	1.21 ± 0.46 ^{c,z}
	Heptanal	11.95 ± 1.52 ^{a,y}	5.74 ± 1.54 ^{b,y}	0.19 ± 0.02 ^{c,x,y}	0.10 ± 0.00 ^{c,y}
	Total Volatiles	80.35 ± 6.88 ^{a,y}	21.19 ± 5.28 ^{b,y}	6.80 ± 0.36 ^{c,x}	1.38 ± 0.45 ^{c,z}
16	2 –Butanona	5.18 ± 1.57 ^{a,x}	0.00 ± 0.00 ^{b,y}	0.02 ± 0.01 ^{b,y}	0.70 ± 0.08 ^{b,x}
	Hexanal	61.64 ± 10.22 ^{a,x}	8.81 ± 3.19 ^{b,z}	2.15 ± 0.46 ^{b,z}	0.43 ± 0.58 ^{b,z}
	Heptanal	11.45 ± 3.15 ^{a,y}	1.13 ± 0.67 ^{b,z}	0.22 ± 0.02 ^{b,x}	0.50 ± 0.23 ^{b,x}
	Total Volatiles	78.28 ± 14.78 ^{a,y}	9.94 ± 3.16 ^{b,z}	2.39 ± 0.43 ^{b,y}	1.63 ± 0.80 ^{b,z}

Means with different superscripts are significantly different (P<0,05)

Figure 1, 2, 3. Outside colour values L, a*, b* in precooked pork meatballs stored under retail display conditions made with different antioxidants.

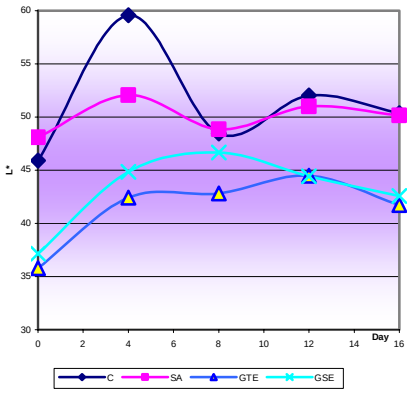

Figure 1: L* means

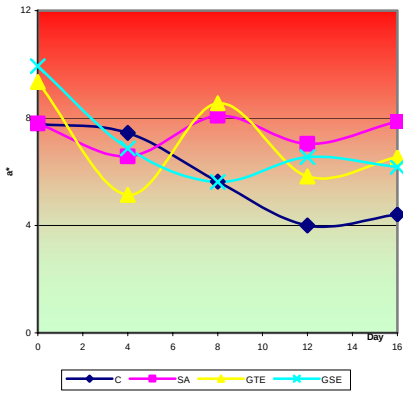

Figure 2: a* means

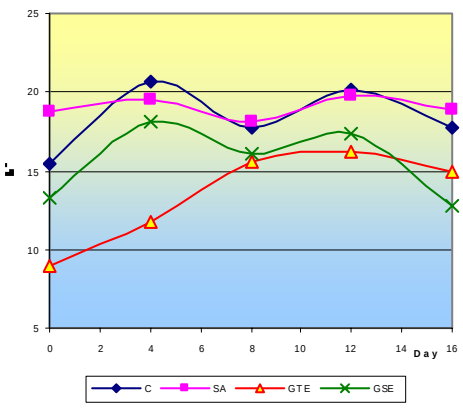

Figure 3: b* means