NTIOXIDANT ACTIVITY OF GREEN AND BLACK TEA IN MEAT MODEL SYSTEMS

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UMMARY

ntioxidant activity of green and black tea as well as their extracts in meat model systems was investigated using the 2-thiobarbituric cid (TBA) test. Green tea was found to possess stronger antioxidant properties compared to black tea. Extracts of green and black ea in water, methanol, ethanol and ethyl acetate indicated that their efficacy was proportional to their total content of phenolic ompounds, expressed as catechin equivalents. Tea catechins are considered to be the major compounds responsible for protection of meat against oxidation and flavour deterioration. Studies on the isolation of individual phenolics of tea and evaluation of their ntioxidant properties are in progress.

INTRODUCTION

Oxidation of lipids in muscle foods is a common cause of their quality deterioration and produces off-flavours and off-odours (Sherwin, 1990; Shahidi and Wanasundara, 1992). Use of chemical additives, particularly nitrite in meat curing has served as a reliable means of quality preservation of products. On the other hand, uncured meats suffer from flavour deterioration during their storage after cooking. Furthermore, there has been a desire and a parallel trend towards the use of natural ingredients in place of chemical additives. Thus, we have initiated a research program to investigate natural sources of food antioxidants and their efficiency in a variety of lipid-containing products.

Tea, whether green or black, is one of the most widely consumed beverages in the world. It is the immature vegetative portion of the tea plant (*Camellia sinesis*). After leaves are collected, fermentation is initiated by leaf withering and rolling. This process brings the phenolic flavan-3-ols in the green leaves and catechol oxidase into contact. This results in enzymatic browning and is responsible for the formation of the characteristic pigments which give colour and flavour to black tea. Tea also contains large quantities of flavan-3-ol catechins of which the most common members are (-)-epicatechin, (-)-epigallocatechin, (-)-epicatechin gallate and (-)-epigallocatechin gallate. Based on their phenolic nature, catechins are expected to impart strong antioxidative effects in food applications as it has been demonstrated for lard using the Active Oxygen Method (Matsuzaki and Hara, 1985).

The present study was designed to make use of both green and black tea, as such, or their extracts in various solvents to possibly extend the shelf-life of cooked comminuted meat products.

MATERIALS AND METHODS

Both green and black tea were obtained from Anhui province of China. They were used, as such, or their extracts prepared in water, methanol, ethanol or ethyl acetate were used following solvent evaporation.

Pork loins were obtained 24h post-mortem from the Newfoundland Farm Product Corporation, St. John's, NF, and were comminuted using a Hobart meat grinder (Hobart MFG Co. Ltd., Model 4146, Don Mills, ON). Ground meat samples were divided into 100 g portions to which 25 mL of H_2O and tea-based compounds were added. Samples, after thorough homogenization, were heat processed for approximately 30 min to an internal temperature of 70±2°C in a water bath at 80±2°C. After cooling, samples were mixed thoroughly, divided into 10 g portions and then individually wrapped. Meats were stored at 4°C in a refrigerator for different periods prior to evaluation of their oxidative state.

The oxidative state of treated meat samples, as compared with the reference devoid of any additive, was evaluated by the classical 2-thiobarbituric acid (TBA) test described by Tarladgis *et al.* (1960) and modified by Shahidi *et al.* (1987). Percent inhibition of lipid oxidation in meat samples was calculated based on average TBA values over a 3-week storage period.

RESULTS AND DISCUSSION

Figure 1 summarizes results of the effect of green and black tea or their extracts on inhibition of oxidation of meat lipids. Green tea was found to be considerably more effective than black tea in retarding lipid oxidation. Phenolic catechins in green tea (Figure 2) are the major compounds responsible for the antioxidative effects imparted to cooked meats. Unlike anthocyanins, tea catechins are not associated with sugar molecules and thus might have stronger antioxidative effects. They act as free radical chain breakers and possibly as chelators of metal ions. Their activities in lard were superior to those of BHA and α-tocopherol at similar molar concentrations (Matsuzaki and Hara, 1985; Namiki, 1990). The lower inhibitory effect of black tea against oxidative deterioration of meat lipids may be, in part, due to extensive oxidation of phenolic catechins during the fermentation process.

Efficacy of tea extracts in water, methanol, ethanol and ethyl acetate is summarized in Figure 1. The effect of extracts of both green and black tea in retarding oxidation was related to their total content of phenolic compounds, expressed as catechin equivalents, and might also depend on the preferential extraction of more active catechins in methanolic solutions. Thus, methanolic extracts showed the highest and ethyl acetate extracts the lowest activity. As expected, black tea extracts were considerably less effective than their green tea counterparts. Based on the results presented here, it is conceivable that green tea and its extracts could provide a practical means for protection of meat and meat products against oxidative deterioration and to extend the shelf-life for pre-cooked meats. In all cases examined, the effect of green tea or its extracts was superior to that of commonly used antioxidants such as α-tocopherol and BHT. Further work in this area is in progress.

ACKNOWLEDGEMENTS

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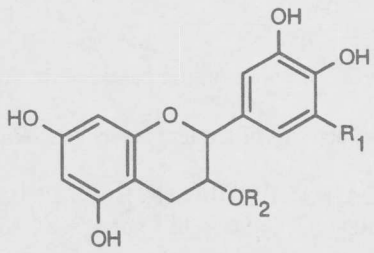
Inhibition of TBARS Formation, %



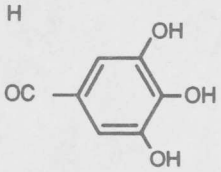
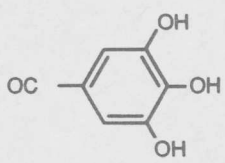
Catechin	R_1	R_2
EC (Epicatechin)	H	H
EGC (Epigallocatechin)	OH	H
ECg (Epicatechin gallate)	H	
EGCg (Epigallocatechin gallate)	OH	

Figure 1. Major antioxidant components of tea leaves.

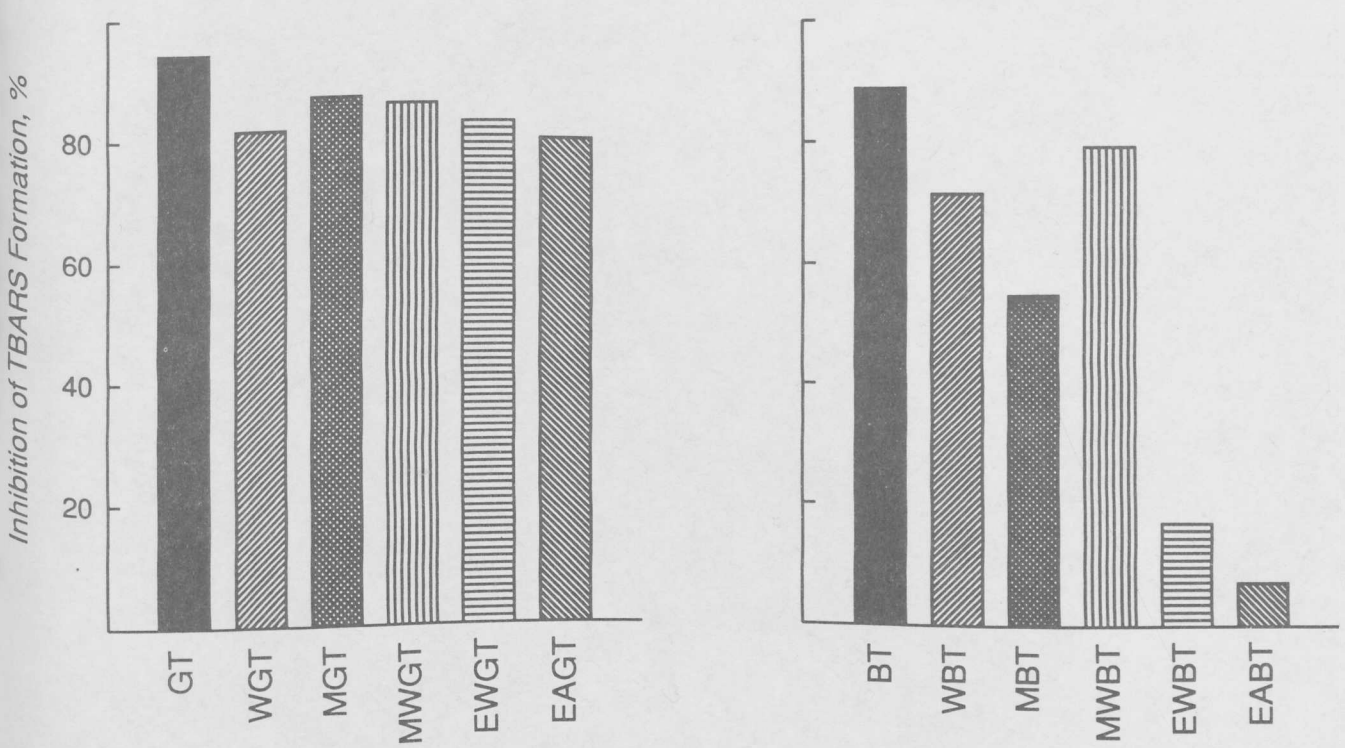


Figure 2. Percent inhibition of formation of TBARS by green tea (GT) and black tea (BT) or their extracts in water (WGT and WBT), methanol (MGT and MBT), 85% methanol (MWGT and MWBT), 95% ethanol (EWGT and EWBT), and ethyl acetate (EAGT and EABT).

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