## ADDITION OF DRIED HERBS DURING PRESSURE COOKING OF MUSSELS AND THEIR EFFECT ON OXIDATIVE STABILITY OF FRESH AND FROZEN MUSSELS

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**Keywords:** Mussels, herbs, TBARS, oxidation

**Background:**
Shellfish are a highly perishable product due to their large content of long chain, highly unsaturated n-3 fatty acids (Wada and Fang, 1992). Oxidative rancidity of lipids during processing and storage of shellfish products gives rise to off-flavours and overall quality deterioration (Ashie *et al.*, 1996). The use of natural antioxidants from plant sources may be an alternative source for compounds capable of protecting lipids in foods. Plant extracts of the Labiatae family, have shown noticeable antioxidant activity in saturated fat systems (Economou *et al.*, 1991). The objective of this study was to determine (1) the optimum working concentration of dried herb when cooked with mussels, using sage as a reference example and (2) the antioxidant activity of a number of dried herbs of the Labiatae family following cooking of mussels and their subsequent storage in chilled and frozen conditions.

**Method:**
Mussels were harvested and departurated (24 hrs) using UV sterilised water. They were cooked in a stainless steel pressure cooker (Prestige, Model 06189XR, Prestige Group, UK) at 15 lbs pressure for 120 s with 0 (control), 2, 4, 6, 8 and 10% dried sage (% of cooking water). Mussels were cooled and heat-sealed in polyamide-polyethylene (20:70) bags (Grace Multiflex GMBH, Germany). Samples were chilled (4°C x 8 d). Lipid oxidation of samples was assessed by the 2-thiobarbituric reducing (TBARS) method of Ke *et al.* (1977). The above procedure was repeated using sage at the determined optimum concentration for whole and ground herb, for assessment of the most suitable form in which it should be added to the cooking waters for optimum effect. Mussels were pressure cooked with basil, oregano, marjoram, rosemary, sage and thyme using the optimum conditions determined from the initial sage studies. They were then placed in heat sealed bags and stored under chilled (4°C x 8 d) and frozen (-20°C x 40 d) conditions. A total of three analyses performed in duplicate was carried out per treatment and statistically assessed using the SPSS 8.0 for windows (SPSS, Chicago, IL, U.S.A).

**Results:**
All concentrations of sage (2-10%) inhibited lipid oxidation (TBARS numbers) of mussels when compared to the control samples (Fig.1). A working concentration of 8% sage was found to be most effective at reducing TBARS values in fresh mussels. Sage, both in ground and whole form, reduced TBARS numbers of mussels compared to control. However, on adding whole sage to mussels, TBARS numbers were significantly ($p<0.05$) reduced compared to mussel samples cooked with ground sage (Fig. 2). When added at a concentration of 8% in whole form; basil, oregano, marjoram, rosemary, sage and thyme, showed reduced TBARS numbers in both chilled (Fig. 3a) and frozen storage (Fig. 3b). When compared to control samples of chilled mussels, thyme and oregano were the most effective herbs in reducing lipid oxidation. The antioxidant activity of herbs in frozen mussels separated into two distinct groups. Marjoram, oregano and thyme were more effective in their inhibition of lipid oxidation than rosemary, sage and basil.

**Conclusion:**
Pressure cooking with herbs basil, oregano, marjoram, rosemary, sage and thyme reduced lipid oxidation during both chilled and frozen storage. Therefore, they would appear to be an effective method in extending the shelflife of shellfish products. The use of herbs in shellfish processing is further enhanced due to their availability and relatively low cost. The results presented in this study provide a novel method for extending the shelflife of shellfish products using herbs. However, these food ingredients may also offer other beneficial effects, particularly in relation to sensory attributes.

**References:**
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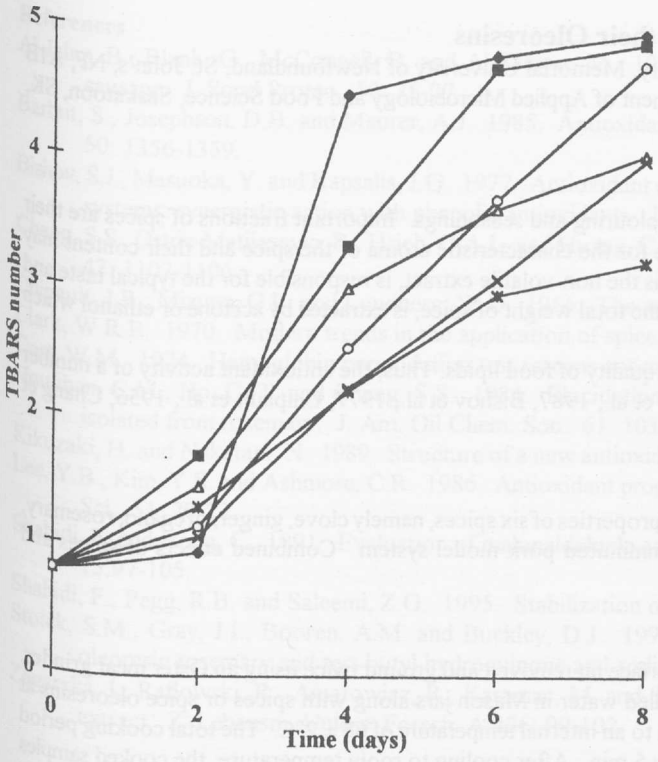


Fig. 1 Oxidative stability of cooked mussels with sage 0 (◆), 2 (■), 4 (Δ), 6 (✖), 8 (✳) and 10% (o) under chilled conditions (4°C x 8 days).

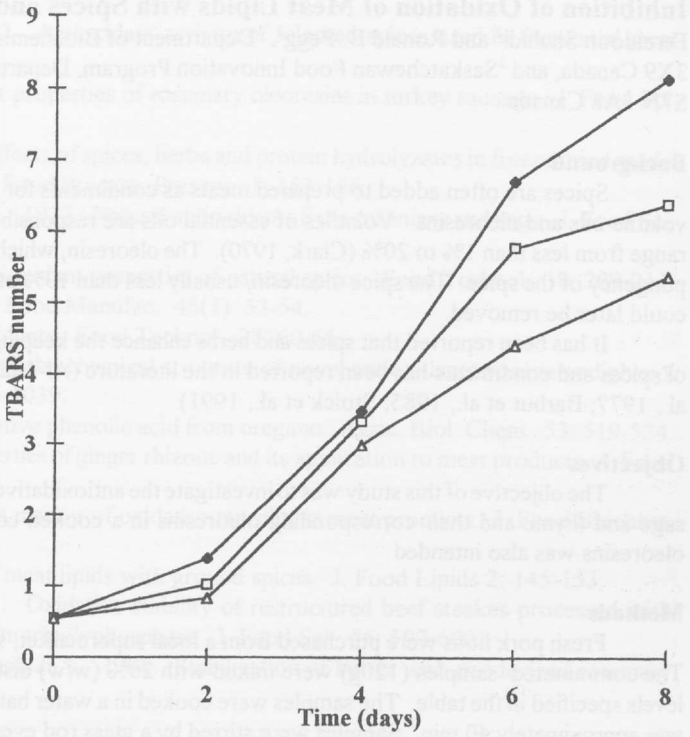


Fig. 2 Oxidative stability of cooked mussels with different forms of dried sage, control (◆), ground (□) and whole (Δ) under chilled conditions (4°C x 8 days).

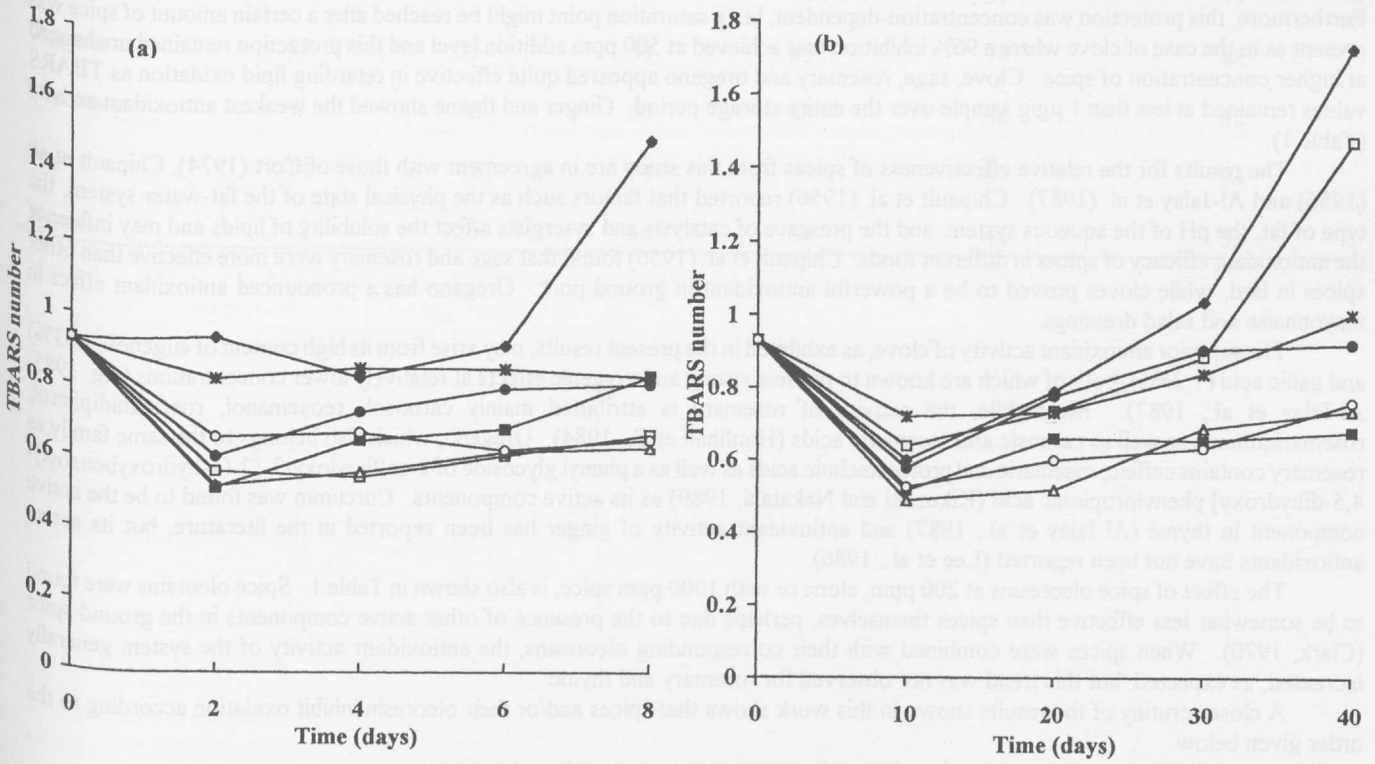


Fig. 3 Oxidative stability of mussels cooked with various herbs under **(a)** chilled conditions (4°C x 8 days) and **(b)** frozen conditions (-20°C x 40 days). Control (◆), basil (□), oregano (Δ), margoram (■), rosemary (✳), sage (●) and thyme (o).