INFLUENCE OF SOYA BUDS ON CHICKEN LIPID OXIDATIVE STABILITY

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Background

During production, processing, distribution and storage, foods undergoes deterioration from chemical and microbial process. Typically oxidative deterioration of meat and meat products result from degradative reactions of fat in raw meat (Sanchez-Escalante et al, 2001). Active oxygen species are possible initiators of these reactions, and their inactivation could provide one mechanism of antioxidative effect.

Various antioxidant, which might play and important role in protecting the cell against damage caused by active oxygen and free radicals have been isolated from natural sources (Yokota et al, 1996). Vitamin E, vitamin C and β-carotene as well as protective enzymes like superoxide dismutase (SOD), catalase and glutathione peroxidase are ubiquitous in plants and animals, and it provides the first line of defense against oxygen toxicity.

Soya beans are exceptionally rich sources of SOD (Bamforth and Pearson, 1985), and they are unusually stable to heat, and could be incorporated into food materials or beverages which need to be pasteurized (Clarkson, Large and Bamforth, 1989).The SOD content of seeds increases dramatically with germination and the in early stages of growth (Giannopolitis and Ries, 1977)

In previous papers, we reported that soya buds has antoxidant activity on fused lard and cooked meat emulsion probably due to high superoxide dismutase (SOD) enzyme concentration present in it (Doval et al, 2001; Doval et al, 2002)

Objective

Our objective was to evaluate the effect of soya buds on chicken lipid oxidative stability using an accelerated model system. The lipid oxidation was quantified by measuring the level of conjugated dienes; hydroperoxides and TBARS.

Materials and Methods

Preparation of soya buds. The soya buds were obtained from previously selected soya beans, which were soaking in water and then germinated in darkness at 30 °C in a controlled temperature chamber. Once the buds reached 1cm of length, they were separated from the beans and were dehydrated at 30 °C during 24 hours in a static drying chamber (13,7 % humidity). Concentrations of 0 % w/w (A) ; 3 % w/w (B) and 6% w/w (C) of triturated dry buds were emulsified within chicken lipids model.

Lipid system. The fused subcutaneous lipid of chicken samples (7,6 g each one) were distributed in open recipients whose relationship surface: quantity was 1.56 cm^2/g and placed in stove to 80 °C under dark and static conditions, in order to causing a rapid oxidation. (Chavez et al, 1998)

Measurement of lipid oxidation. The lipid oxidation was carried out during 48 hours. Conjugated dienes concentration, expressed in milliliters per milligrams for sample, were measured by AOAC official method (AOAC 957.13.1990). Peroxide values, expressed in terms of milliequivalents of peroxide per kilogram for sample, were determined using the IDF-FIL 74A: 1991 official method (expressed as milliequivalents of oxygen per kilogram of sample). Thiobarbituric acid reactive substances (TBARS) were measured according to the spectrophotometric method at 531 nm (Beckman DU® 640B spectrophotometer) and expressed as μmoles of malonaldehyde per kilogram of dry matter using tetramethoxypropane as the standard.

SOD Assay.2 g of dehydrated buds were ground in a grinder, and were extracted in a 40 ml 50 mM tris-HCl buffer, pH 8.0, containing 1 mM EDTA, through all night at 4 °C. The resulting slurry was centrifuged at 5000 rpm for 20 min. The SOD assay is routinely used for the measurement of superoxide dismutase in barley. This method relies on the inhibition by superoxide dismutase of the reduction of cytochrome *c* by superoxide anions produced in the oxidation of xanthine. (Bamforth, 1983). SOD from *Bacillus stearothermophilus* was used to compare (Sigma Chem Co.). Protein content in crude extract was measured by the method of Biuret (Doumas et al, 1971)

Statistical design and analysis. Data obtained during storage were analyzed by duplicated using a response surface methodology in Statgraphics Plus for Windows® 4.0 software package. Experimental design adopted was multilevel factorial 3^2, in which the two factors or independent selected variables were: Soya Buds Concentration (C) and Storage Time (T), while the variable response were: Conjugated dienes (CD); Peroxide value (PV) and Thiobarbituric-acid-reactive substances (TBARS).

Results and Discussion

According to the results obtained, both soya buds concentrations assayed have exerted antioxidant effect on the chicken lipid model system. Table 1 shows conjugated dienes, hydroperoxides and acid 2-thiobarbituric reactive substances formation, for the control (no additives); 3% and 6% soya buds added samples.

The reduction of 60%; 51% and 23% for peroxide value, conjugated dienes and TBARS respectively, was reached for higher concentration assayed at 48 h. Total activity SOD and specific SOD activity in crude extracts from dehydrated soya buds was 1,135 units/g dry matter and 7.19 units /mg protein, respectively (Doval et al, 2001).

Figure 1 shows CD, PV and TBARS formation through time. From the results shown in this figure it was observed that antioxidant effect is stronger on hydroperoxides formation than CD and TBARS development, the other measurements used for evaluating the effectiveness of the antioxidant. This reinforces the theory that antioxidant effect of soybean buds is based on content of superoxide dismutase enzyme, which catalyze dismutation of superoxide radicals to oxygen and hydrogen peroxide.

Besides, if we know that lipid oxidation whole process cannot be evaluated following the formation of one indicator only (primary or secondary oxidation products), the evaluation of the antioxidant effect should be monitored with indicators of different steps in the oxidation process.

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Table 1. Result of the chemical analyses

h	CD (ml/mg)			PV (meq O_2/L)			TBARS (µmol MAD/Kg)		
	A	B	C	A	B	C	A	B	C
0	0.39±0.01	0.39±0.01	0.39±0.01	16.93±0.62	16.93±0.62	16.93±0.62	15.88±0.25	16.94±0.25	16.94±0.25
24	1.83±0.07	1.01±0.04	1.19±0.03	147.9±13.6	85.46±6.11	87.18±4.86	35.87±0.44	36.51±0.37	44.24±0.30
48	3.19±0.02	2.58±0.01	1.56±0.07	534.3±166	304.43±8.2	212.39±33.	48.35±1.39	37.25±1.50	37.40±1.72

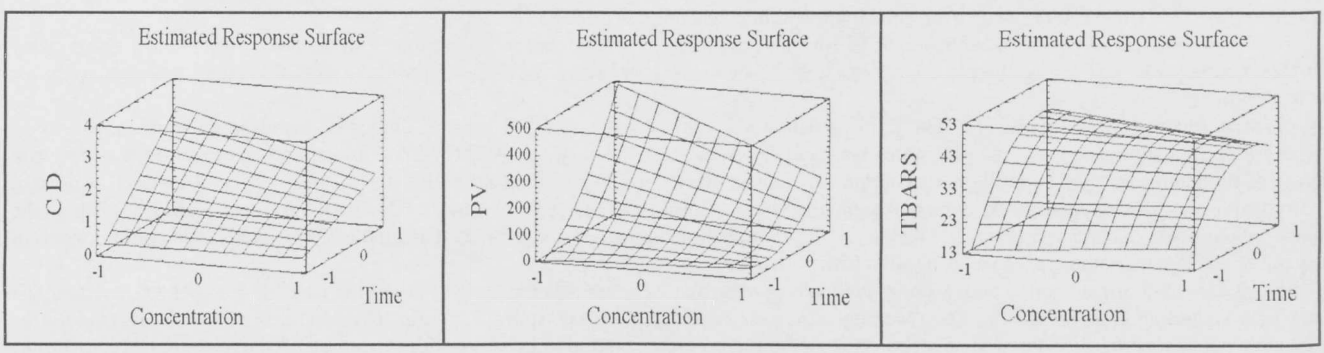

Figure 1. Response surface plot of predicted average a) Conjugated dienes; b) Peroxide value and c) TBARS