BIOACTIVE COMPOUNDS AND ANTIOXIDANT ACTIVITIES OF EXTRACTS FROM GREEN COFFEE BEANS OBTAINED WITH DIFFERENT EXTRACTION SOLVENTS AND TIMES

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I. INTRODUCTION

Lipid oxidation is considered one of the main causes of deterioration of meat and meat products, causing a negative effect on sensory quality attributes [1]. One of the objectives of the food industry is to provide consumers with wholesome foods with a minimum of artificial ingredients. Inclusion of natural ingredients displaying molecules with bioactive properties [2] has been one of the current strategies to pursue this pivotal objective. Green coffee beans shown to be an important source of bioactive metabolites such as chlorogenic acid [3]. Thus, the aim of this experiment was to evaluate the phytochemical content and antimicrobial activity of extracts obtained from green coffee beans.

II. MATERIALS AND METHODS

Green coffee beans and textured soy (used as a control) were ground at 80 mesh particle size. The extracts were obtained using different solvents (water, ethanol, and 1:1 water-ethanol mixture) with the ultrasound-assisted extraction method (42 kHz; 25°C), to different extraction times (30 and 60 min). The resulting extracts were evaluated for contents of carbohydrates; total phenols; total flavonoids; caffeoylquinic acid; and condensed tannins. The antioxidant activity of extracts was assessed by inhibition of radical cations through the ABTS; inhibition of free radicals through the DPPH; reducing power using the Prussian blue and FRAP [4]. Data were subjected to analysis of variance (GLM-ANOVA), and treatment means were compared by the Tukey Kramer test at 5%.

RESULTS AND DISCUSSION

As shown in Table 1 the ethanolic extract showed the highest ($p<0.05$) concentration of condensed tannins and a higher content of phenols similar to that of the water-ethanol 1:1 extract, which in turn, showed the highest ($p<0.05$) content of chlorogenic acid and carbohydrates. However, the highest ($p<0.05$) flavonoid content was found in the aqueous extract (Table 1). In general, all extracts had a good response regarding antioxidant activity (Table 2). The ethanolic extract demonstrated antiradical activity against DPPH, ABTS as well as reducing power and FRAP similar ($p>0.05$) to those of ascorbic acid. Likewise, the water-ethanol 1:1 extract presented an antiradical activity against ABTS and a reducing power similar ($p>0.05$) to ascorbic acid.

Soy flours, which are rich in polyphenols and isoflavonoids have been widely used in the formulation of a variety of foods including processed meats to fortifying their nutritional quality, and for improving texture and techno-functional properties [5]. However, in this study a better antioxidant performance of green coffee extracts was observed compared to soy extracts (Table 2). Previous studies [6,7] demonstrated the antioxidant activity and biological activity of green coffee extracts as a result of the polyphenolic compounds it contains.

Table 1 – Comparison of the phytochemical compounds of green coffe extracts.

Treatment	Condensed tannins (% inhibition)	Phenols (mg galic acid equivalents/g)	Flavonoids (mg quercetin equivalents/g)	Chlorogenic acid (abs 700 nm)	Carbohydrates (mg glucose equivalents/g)
1	152.70 ± 12.75^{b}	101.00 ± 4.83^{b}	11.95 ± 1.30^{a}	82.15 ± 2.33^{b}	13.97 ± 1.44^{cd}
2	191.34 ± 12.78^{a}	125.20 ± 5.70^{a}	4.08 ± 0.57^{b}	44.14 ± 2.54^{c}	14.57 ± 0.75^{c}
3	49.56 ± 2.58^{d}	121.65 ± 3.63^{a}	3.70 ± 0.53^{b}	112.00 ± 1.53^{a}	33.00 ± 1.72^{a}
4	43.95 ± 2.81^{d}	22.87 ± 1.72^{c}	-	3.37 ± 0.50^{d}	3.55 ± 0.64^{e}
5	118.99 ± 8.66^{c}	17.68 ± 0.89^{d}	-	3.34 ± 0.55^{d}	11.63 ± 3.32^{d}
6	-	23.96 ± 1.70^{c}	-	2.91 ± 0.22^{d}	26.87 ± 2.24^{b}

T1: Green coffee (Water); T2: Green coffee (etOH); T3: Green coffee (1:1); T4: Soy (Water); T5: Soy (etOH); T6: Soy (1:1).

Table 2 – Comparison of the antioxidant activity of green coffee extracts.

Treatment	DPPH (% inhibition)	ABTS (% inhibition)	Reducing power (mg quercetin equivalents/g)	FRAP (mg Fe^{2+} equivalents /g)
1	30.99 ± 3.27^{c}	84.71 ± 0.44^{b}	1.10 ± 0.03^{b}	102.73 ± 6.96^{c}
2	93.52 ± 0.97^{a}	89.31 ± 0.56^{a}	1.40 ± 0.02^{a}	177.13 ± 2.06^{a}
3	71.35 ± 2.14^{b}	92.06 ± 0.27^{a}	1.41 ± 0.05^{a}	169.26 ± 5.26^{b}
4	19.02 ± 2.70^{d}	51.07 ± 3.30^{c}	0.14 ± 0.03^{c}	18.99 ± 1.26^{d}
5	3.79 ± 1.42^{e}	47.86 ± 4.74^{c}	0.05 ± 0.02^{d}	13.15 ± 2.78^{e}
6	1.23 ± 0.47^{e}	80.98 ± 5.73^{b}	0.06 ± 0.02^{d}	14.56 ± 1.63^{de}
7	92.06 ± 0.89^{a}	93.08 ± 0.26^{a}	1.40 ± 0.03^{a}	173.45 ± 3.05^{ab}

T1: Green coffee (Water); T2: Green coffee (etOH); T3: Green coffee (1:1); T4: Soy (Water); T5: Soy (etOH); T6: Soy (1:1); T7: Ascorbic acid.

III. CONCLUSION

The results indicate that green coffee extracts can be used as an ingredient of natural origin to complement or strengthen antioxidant properties of textured soy in the formulation of meat products.

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