

PHYTOCHEMICAL EQUIVALENCE OF BLACK BEAN CULTIVARS TO NEGRO 8025, AN OUTSTANDING CULTIVAR FOR REDUCING CHRONICALLY DEGENERATIVE DISEASES IN RATS

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Consumption of black and pinto seeded genotypes have shown a beneficial effect from a health point of view (1,2). Among 12 cultivars, Negro 8025 and Pinto Durango displayed the highest reduction of glucose and cholesterol in blood (3), and in the number and size of colon cancer tumors in rats (2). It has been hypothesized that different seed phytochemicals are responsible of such effects (4). Given the difficulty of assessing the biological effect of all black seeded cultivars that are consumed, we hypothesize that if the phytochemical profile of a black cultivar was similar to that of Negro 8025, then the same biological effect might be observed. Experimental black seeded lines and cultivars bought from local markets were analyzed along with a sample of T-39 produced in Celaya, Gto. in 2005. Total fiber was measured with the Dietary Fiber Assay kit (SIGMA, TDF-100A). Total phenolics and total tannins were determined following George *et al.* (5) and Desphande and Cheryan (6) methods, respectively. Anthocyanins were determined according to Abdel-Aal and Hucl (7) and oligosaccharides by HPLC using the method of Muzquiz *et al.* (8). Isoflavones (daidzein and genistein) were assessed by HPLC. With exception of lines (NSLB/8025/N203)-201 and (NSLB/8025/N203)-250 and cultivar Negro Zacatecas, the rest of lines and cultivars showed similar fiber content as Negro 8025 (Table 1). Negro Queretaro, a landrace cultivar, showed an outstanding content of 18.95 %, 50% higher than that of Negro 8025. It has been mentioned that fiber is one of the main components responsible for the prevention of colon cancer (4). Also, fiber is believed to be involved in the hypocholesterolemic effect of foods (9). All lines and cultivars showed higher total phenolics than Negro 8025, with the exception of line (NSLB /8025/N203)-250 that showed 22% less total phenolics (Table 1), other lines and cultivars showed from 11.6 % (NG0 99176) to 176 % (NG0 99038) higher total phenolics in comparison to Negro 8025. As for tannin and anthocyanins content NG0 99176 had a lower content than Negro 8025 (Table 1). Lines (NSLB /8025/N203)-201 and (NSLB/8025/N203)-250 also showed lower anthocyanins content as well as Michigan 1 and 2 market samples. These last two samples had the lowest tannin content. Plant phenolics participate in decreasing intestinal tumors in animal models of adenomatous polyps (11).

Table 1. Fiber content, total phenolics and anthocyanins content of cooked black bean seeded bred lines and cultivars compared to that of Negro 8025.

Line/cultivar	Fiber (%, dwb)	Total phenolics (mg/100 g, db)	Total tannins (mg/100 g, db)	Anthocyanins (mg/100 g, db)
(NgINIFAP/Ng 8025)-100	11.3 ± 1.0	402 ± 22	25.5 ± 2.0	1.7 ± 0.0
NG0 99176	6.4 ± 0.3	286 ± 11	13.3 ± 1.1	2.6 ± 0.0
NG0 99038	12.7 ± 1.2	711 ± 21	68.8 ± 3.6	54.8 ± 2.0
(NSLB/8025/N203)-201	12.7 ± 1.1	676 ± 46	32.1 ± 2.2	80.7 ± 3.1
(NSLB/8025/N203)-250	10.1 ± 1.6	211 ± 16	46.1 ± 3.9	14.9 ± 1.0
Negro Durango	15.9 ± 1.7	458 ± 19	132.4 ± 6.3	24.0 ± 1.3
Negro Jamapa	10.6 ± 1.6	352 ± 17	47.8 ± 1.3	15.9 ± 0.8
Negro Querétaro	19.0 ± 2.1	390 ± 16	47.8 ± 1.0	34.3 ± 3.2
Negro Otomí	13.7 ± 1.3	378 ± 10	59.6 ± 3.2	25.8 ± 1.5
Negro San Luis	15.9 ± 2.3	377 ± 18	44.3 ± 2.1	33.3 ± 2.9
Negro Tacana	13.0 ± 1.2	343 ± 15	36.1 ± 2.0	6.9 ± 0.9
Negro Zacatecas	9.7 ± 0.1	613 ± 31	53.7 ± 2.8	42.6 ± 2.9
Negro Michigan (1) ¹	13.3 ± 2.0	347 ± 21	6.7 ± 0.2	12.1 ± 1.1
Negro Michigan (2)	15.5 ± 1.4	487 ± 31	6.7 ± 0.2	17.5 ± 1.9
T-39	15.4 ± 1.8	378 ± 19	39.6 ± 2.0	43.8 ± 4.7
Negro 8025 (check)	12.5 ± 1.2	258 ± 11	38.4 ± 1.2	29.3 ± 2.2

¹samples were bought from the market at Irapuato, Gto. (1) and (2) Queretaro, Qro.

Oligosaccharides and isoflavones. Only four cultivars showed similar (Michigan 2) or higher (Negro Durango, Negro Otomi, and Negro San Luis) raffinose content than Negro 8025 (Table 2). Also, all lines and cultivars showed higher stachyose content than Negro 8025 with exception of line NG0 99038. Non-verbascose was detected. Oligosaccharides along with resistant starch and insoluble fiber are partially responsible for the prevention of colon cancer. This type of fiber is fermented by bifido bacteria in the colon producing short chain fatty acids which act as potential antiproliferative differentiation agents (11). On the other hand, lines (NSLB/8025/N203)-201 and (NSLB/8025/N203)-250 and Negro Zacatecas had higher daidzin content than Negro 8025; meanwhile all genotypes including Negro 8025 showed similar genistin content (Table 2). Seeds of Negro Durango, Negro Queretaro and T-39 contained more than 75% of all phytochemicals compared to Negro 8025; meanwhile, line NG0 99176 showed less than 75% of all phytochemicals with exception of total phenolics. Our hypothesis is that cultivars Negro Durango, Negro Queretaro and T-39 will show a similar effect on colon cancer and diabetes in rats as Negro 8025; meanwhile, line NG0 99176 will not show the same beneficial effect. It will be of great interest to assess these cultivars in colon cancer or diabetes to confirm such hypothesis.

Table 2. Oligosaccharide (raffinose and stachyose) and isoflavone contents (mg/100g, db) of cooked black seeded bean bred lines and cultivars.

Line/cultivar	Raffinose	Stachyose	Daidzin	Genistin
(Ng INIFAP/Ng 8025)-100	1023 ± 22	500 ± 12	44.7	0,9
NG0 99176	907 ± 6	540 ± 29	61.8	0,9
NG0 99038	890 ± 12	225 ± 4	118.8	1,3
(Negro Bola/8025/N203)-201	893 ± 10	338 ± 6	155.8	1,1
(Negro Bola/8025/N203)-250	964 ± 28	535 ± 11	68.0	0,8
Negro Durango	2489 ± 40	277 ± 12	76.1	0,9
Negro Jamapa	1452 ± 35	555 ± 10	62.2	1,0
Negro Querétaro (landrace)	1783 ± 38	315 ± 12	88.0	0,9
Negro Otomí	3399 ± 21	379 ± 8	50.7	0,9
Negro San Luis (landrace)	2563 ± 19	319 ± 62	59.8	0,0
Negro Tacana	1305 ± 21	591 ± 11	54.8	0,8
Negro Zacatecas (landrace)	1025 ± 10	754 ± 45	107.5	1,1
Michigan (1)	1282 ± 12	570 ± 2	76.8	0,9
Michigan (2)	2129 ± 47	518 ± 78	79.1	0,9
T-39	1972 ± 13	427 ± 5	90.9	1,0
Negro 8025	2087 ± 18	238 ± 8	94.4	1,1

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