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SOME NUTRIENT CHARACTERISTICS OF GOLDENBERRY (*PHYSALIS PERUVIANA* L.) CULTIVAR CANDIDATE FROM TURKEY

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Abstract

This study was the first record on nutrient characteristics of goldenberry types in Turkey. In this study; 6 types of goldenberry were used as material which were collected from different side of Turkey and cultivated in observation parcel of Atatürk Horticultural Central Research Institute Yalova (Turkey). Obtained data will be used for future selection and registration steps of these types. For this purpose carotene, vitamin C, crude fiber, total phenolic and mineral matter content and antioxidant activity of goldenberries were determined. The results showed that goldenberry types are rich in vitamin C, total phenolic content and minerals (especially phosphorus) content. Also they have been found as a rich source of crude fiber and carotene. 6th type has the highest total phenol (48.60 mg GAE/100g), crude fiber (4.10%) and vitamin C (34.86 mg AAE/100g) content and 3rd type has the lowest total phenol (42.16 mg GAE/100g), vitamin C (31.40 mg AAE/100g) and carotene (1.98 mg/100g) content. According to evaluation of these results 6th type was determined as featured types for registration as new cultivar.

Key words: *Physalis peruviana L., carotene, crude fiber, total phenolic content, mineral matter*

INTRODUCTION

Physalis peruviana L.*,* belongs to the *Solanaceae* family and *Physalis* genus, commonly known as goldenberry or cape gooseberry in English speaking countries. Different varieties of *P. peruviana* are recognized in many countries and are cultivated commercially in tropical and subtropical countries such as South Africa, America, New Zealand and Spain (Morton, 1987).

They are grown in warm climates region of Turkey, especially Black Sea, Marmara, Aegean and Mediterranean regions (Besirli, 1998).

Generally, the fruit of goldenberry is consumed fresh or dried like raisin. It is also used in sauces, glazes for meats, seafood (NRC, 1989). Currently, there are different products processed from goldenberry fruits such as juice, pomace jams, chocolate-covered candies, other products sweetened with sugar as a snack (Ramadan and Moersel, 2009). In European markets, it is used as ornaments in meals, salads, desserts and cakes (Puente et al., 2010).

The fruits of goldenberry were reported to have many medicinal properties such as antispasmodic, diuretic, antiseptic, sedative, analgesic, helping to fortify the optic nerve, throat trouble relief, elimination of intestinal parasites and amoeba (CCI, 1994).

Studies indicated that eating the fruit of goldenberry reduces blood glucose after 90 min postprandial in young adults, causing a greater hypoglycaemic effect after this period (Rodríguez & Rodríguez, 2007).

The fruit of goldenberry has been stated as a rich source of carotene and its major components are its high amounts of polyunsaturated fatty acids, vitamins A, B and C and phytosterols, as well as the presence of essential minerals, vitamins such as E and K_1, with anolides and physalins, which together would give them medicinal properties described above (Ombwara, 2004; Puente et al., 2010).

The aim of this study was to investigate some chemical properties and nutrient composition of goldenberry fruit which were collected from different side of Turkey and cultivated in Atatürk Horticultural Central Research Institute Yalova (Turkey). Obtained data was used for future selection and registration steps of these types. With this study; main features of goldenberry which new known for the food industry and consumers of Turkey were determined.

MATERIALS AND METHODS

Fruits of 6 types of goldenberry were used as material. They were collected from different side of Turkey, numbered from 1 to 6 and cultivated at same conditions in Atatürk Horticultural Central Research Institute.

Figure 1. Goldenberry fruits

Mineral Matter Analysis. Golderberry samples were dried, milled and analyzed according to method of wet decomposition by using sulfuric acid + hydrogen peroxide solution according to Anonymous (1980). Amounts of K, Ca, Mg, Fe, Cu, Zn and Mn elements were determined with atomic absorption spectrophotometer (Perkin-Elmer AAnalyst 700, USA). P element was calculated as colorimetric with vanadomolibdofosforic acid method (Lott et al., 1956).

Ascorbic Acid Analysis. Official spectrophotometric method was used according to AOAC 1970.

Crude Fiber Analysis. Samples were boiled with acid (1.25% H_2SO_4), then alkaline (1.25% NaOH). Later, the residues were burned in an ash furnace (AOAC, 1970).

Extraction of samples for Amount of Total Phenolic Compounds and Antioxidant Activity Analysis: 3 g samples were weighed fresh goldenberry fruits and mixed with 25ml methanol then homogenized for 2 min. and homogenates were kept at +4 °C for 12 h. Samples were centrifuged at 15,000 rpm for 20 min. and liquid phases in methanol were collected with Pasteur pipettes into amber bottles then were stored at -20 °C until analysis. These extracts prepared were used both antioxidant activity and amount of total phenolic compounds (Thaipong et al., 2006).

Amount of Total Phenolic Compounds Analysis. Amount of total phenolic compounds was determined by the Folin - Ciocalteu method. The 150 µl of extract, 2400 µl of distilled water, and 150 µl of 0.25 N Folin - Ciocalteu reagent were combined in a plastic vial and then mixed well using a Vortex. The mixture was allowed to react for 3 min then 300 µl of 1N Na_2CO_3 solution was added and mixed well. The solution was incubated at room temperature (23°C) in the dark for 2 h. The absorbance was measured at 725nm using a Hitachi U-2900 brand spectrophotometer (Tokyo, Japan) and the results were expressed in gallic acid equivalents (GAE mg/100 g) using a gallic acid (0–0.1 mg/ml) standard curve (Thaipong et al., 2006).

Antioxidant Activity Analysis. The DPPH (2,2-difenil-1-pikrilhidrazil) assay was done according to the method of Thaipong et al. (2006). The stock solution was prepared by dissolving 24 mg DPPH with 100 ml methanol and then stored at -20°C until needed. The working solution was obtained by mixing 10mL stock solution with 45 ml methanol to obtain an absorbance of 1.1±0.02 units at 515 nm using the spectrophotometer. Mushroom extracts (150 µl) were allowed to react with 2850 µl of the DPPH solution for 24 h in the dark. Then the absorbance was taken at 515 nm. The standard curve was linear between 25 and 800 µM Trolox. Results were expressed in µM TE/g.

RESULTS AND DISCUSSIONS

Reducing sugar rates of goldenberry types were determined between 6.55 and 7.80 % (Table 1). In a similar study; Sharoba and Ramadan (2010) reported that reducing sugar rates 8.23% in goldenberry fruit.

In our study, the carotene contents of the goldenberry types were found very close to each other. These values were between 1.98-2.30 mg / 100 g (Table 1). Ombrawa (2004) and Sharoba and Ramadan (2010) reported carotene contents respectively as 1.61 and 2.38 mg/100g.

According to Table 1, ascorbic acid amounts of goldenberry samples have showed variability between 35.10-31.40 mg/100 g. Ascorbic acid amounts were given 43.0 mg/100 g in study done by NRC (National Research Council, 1989) and 26,00 mg/100 g in study done by CCI (Corporación Colombia Internacional, 1994) and also 20,00 mg/100 g by Fischer et al.(2000).

The highest crude fiber ratio was calculated as 4.10 % in 6th type goldenberry sample, while the lowest crude fiber ratio was calculated as 3.18 % as in 1th type goldenberry sample (Table 1). Other researchers reported crude fiber ratios as 4.9 % (NRC, 1989); 4,8 % (CCl,1994) and 3.6 % (Repo Depo de Carrasco and Zelada, 2008).

Table 1. Reducing sugar, carotene, ascorbic acid and crude fiber content of goldenberry types

Types	Reducing Sugar (%)	Carotene (mg/100g)	Ascorbic Acid (mg/100g)	Crude Fiber (%)
1	6.55	2.10	33.90	3.18
2	6.79	2.26	33.15	3.24
3	7.80	1.98	31.40	3.85
4	7.20	2.24	35.10	3.94
5	6.21	2.20	32.54	4.02
6	7.75	2.30	34.86	4.10

Amounts of total phenolic compound (TPC) for goldenberry are showed in Table 2. As a result of the analysis, 6th type has the highest TPC amount (48.60 mg GAE/100 g) and 3rd type the lowest TPC (42.16 mg GAE/100 g). In a study conducted by Restrepo (2008), amount of TPC has been specified 40,45±0,93 mg GAE/100 g; in another study has been reported as 39,15±5,43 mg GAE/100 g (Botero, 2008). In terms of TPC amounts, our results have been showed compatibility with literature values.

Antioxidant activity of goldenberry types were determined between 604.69 - 514.06 TEμM/100 g (Table 2). Both Restrepo (2008) and Botero (2008) carried out DPPH method in their studies and they stated antioxidant activity of goldenberry fruit as 210.82±9.45 and 192.51±30.13 TEμM/100 g, respectively. When Table 2 is examined, it was seen that our results are higher than results of Restrepo (2008) and Botero (2008).

Table 2. Amounts of total phenolic compound and antioxidant activities of goldenberry types

Types	Amount of Total Phenolic Compounds (mg GAE/100g)	Antioxidant Activity (TEμM/100g)
1	46.91	566.27
2	47.67	554.69
3	42.16	514.06
4	48.39	604.69
5	48.53	552.08
6	48.60	569.24

Mineral matter amounts of types were found as N 1160-1460 mg/100 g, P 178,46-233,49 mg/100 g, K 1794,98-19,68 mg/100 g, Ca 34,12-43,65 mg/100 g, Mg 102,50-122,51 mg/100 g, Fe 3,68-4,09 mg/100 g, Mn 0,59-0,78 mg/100 g, Zn 1,78-2,32 mg/100 g, Cu 2,19-3,28 mg/100 g, calculated on the basis of total dry matter (Table 3).

In a study carried out in Colombia, mineral matter amounts of goldenberry fruits (on the basis of fresh weight) were informed as: P 27 mg/100 g, K 467 mg/100 g, Ca 23 mg/100 g, Mg 19 mg/100 g, Fe 0,09 mg/100 g, Mn 0,20 mg/100 g, Zn 0,28 mg/100 g, Cu 64 mg/100 g, Na 6 mg/100 g, Cl 1 mg/100 g, S 10 mg/100 g, Ni 0,02 mg/100 g (Leterme et al., 2006). In others studies also were reported: P 55,3 mg/100 g, Ca 8,0 mg/100 g, Fe 1,23 mg/100 g (Ombwara, 2004); P 34 mg/100 g, K 210 mg/100 g, Na 2 mg/100 g, Ca 28 mg/100 g, Fe 0,3 mg/100 g, Mg 7 mg/100 g (Musinguzi et al., 2007).

Amounts differences of mineral matter in between our research and literature have been caused by different climate and growing conditions of the goldenberries.

Table 3. Mineral matter of goldenberry types (mg/100 g dry matter)

Types	N	P	K	Ca	Mg	Fe	Mn	Zn	Cu
1	1160	214.91	1911.99	37.37	102.92	3.76	0.59	1.88	2.19
2	1200	217.61	1968.77	40.55	103.13	3.68	0.60	1.78	2.44
3	1220	178.46	1801.85	34.12	102.50	3.72	0.65	1.99	2.88
4	1460	233.49	1794.98	43.65	122.51	4.09	0.78	2.32	2.97
5	1325	222.31	1903.15	41.39	107.82	4.04	0.65	2.14	3.28
6	1455	220.62	1954.12	42.54	115.36	4.02	0.62	2.18	3.08

CONCLUSIONS

Plant phytochemicals especially phenolic compounds are thought to protective cells against oxidative damage and aging effects etc. In this study fruits of goldenberry types are detected as rich source for vitamin C, carotene and phenolic compounds. This study was the first record on nutrient characteristics of goldenberry types in Turkey. According to the analysis results, it was seen remarkably that goldenberry fruit is a good source crude fiber and carotene, furthermore it have low sugar content. 6th type has the highest total phenol, crude fiber and vitamin C content. According to evaluation of results 6th type was considered proper to select and stand out for registration and certification as a new cultivar.

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