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Research Article

Nutrient Components Analysis of Three Genotypes Chinese Dwarf Cherry (*Prunus humilis*) Fruits

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Abstract: Taking three genotypes (small-fruit-type, medial-fruit-type and big-fruit-type) Chinese wild dwarf cherry (*Prunus humilis*) which living in the same circumstances as tested materials, the mineral nutrient components and amino acid contents were determined, to provide the basis for wild dwarf cherry germplasm resources development and effective component utilization. The results showed that, Chinese wild dwarf cherry fruits were rich in mineral nutrient and amino acid and the contents were different within three genotypes. The mineral nutrient contents of small-fruit-type fruits were higher than that of big-fruit-type, especially calcium element was most obvious, the maximum was 6751.07 mg/kg and minimum was 581.07 mg/kg. The total amino acid content, essential amino acids content for big-fruit-type higher than the small-fruit-type. Maximum content were respectively 7648.60 mg/100 g and 1307.72 mg/100 g, the essential amino acid content accounted for 19.75~22.83% of total amino acid. The studies suggested that Chinese wild dwarf cherry was a natural and effective calcium and amino acid supplement to people.

Keywords: Amino acid, Chinese dwarf cherry (*Prunus humilis*), component analysis, ICP-OES, mineral nutrient

INTRODUCTION

Chinese dwarf cherry (*Prunus humilis*) is a kind of Chinese endemic wild species, which extensively distributed in north of China (Wang *et al*., 2005; Zhao *et al*., 2010). Their seeds are widely used in medicine as laxatives, diuretic and detumescence. Their fruits are rich in sugar, amino acid, vitamin C and several kinds of mineral nutrient elements, especial the Ca and Fe content are higher than many other fruits (Cao *et al*., 1999; Chen *et al*., 2004, 2005; Liu *et al*., 2011; Xue *et al*., 2008).

It is well known that mineral nutrient and amino acid as the essential element to human body is closely related to growth and development (Chen and Lu, 1989; Wang, 1992; Zhang, 2009). So, we took three genotypes Chinese dwarf cherry (*Prunus humilis*) as materials to study their mineral nutrient and amino acid contents to provide a scientific basis for their further development and utilization.

RESULTS AND DISCUSSION

Mineral nutrient component analysis: There were obvious differences in three genotypes *Prunus humilis* fruits mineral nutrient element content (Table 1). In addition to Fe content did not change obviously, the other nutrient element content in small-fruit-type were higher than big-fruit-type, especially Ca content ($p<0.05$); the maximum was 6751.07 mg/kg, while the minimum was 581.07 mg/kg. The other nutrient element content variation not significant ($p>0.05$), but Zn, Mn content was about 8 times the difference. Thus, the level of mineral nutrient content of *Prunus humilis* fruit, small fruit were generally higher than the big fruit type, especially calcium element.

Amino acid nutritional components analysis: It can be seen from Table 2 that *Prunus humilis* fruits contain at least 17 kinds of amino acids, aspartic acid, proline, glycine, glutamic acid, serine, leucine, alanine were the most abundant species. And with the fruits size variation the amino acids content existed differences, some showed increasing, some showed decreasing; except aspartic acid and proline content in three genotypes fruits exist obviously difference ($p<0.05$), no significant differences were found in other kinds of amino acid content ($p>0.05$). The Total Amino Acid (TAA) content average value range of 3973.93~5135.05 mg/100 g (fruit fresh weight basis), the big-fruit-type fruit content was highest among three types fruits, the maximum value is 7648.60 mg/100 g. The essential amino acid content average value range of 907.13~1087.64 mg/100 g (fruit fresh weight basis), the big-fruit-type fruits content was highest among three types fruit too; the maximum value is 1307.72 mg/100

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Table 1: Mineral nutrient component analysis of three genotypes *Prunus humilis* fruits (mg/kg dry weight basis)

	Small-fruit-type (n = 11)		Medial-fruit-type (n = 11)		Big-fruit-type (n = 11)	
Indices	Scope	Mean±SD	Scope	Mean±SD	Scope	Mean±SD
Ca	2289.76-6751.07	3979.16±1732.64 bB	1895.92-2741.21	2112.50±315.82 bB	581.07-1554.30	1200.28±389.43 aA
K	4033.21-4840.55	4451.90±323.47 aA	3783.20-4630.96	4301.93±292.42 aA	4144.05-4513.52	4270.98±139.92 aA
Mg	415.57-1044.49	647.72±221.91 bA	372.02-595.49	491.87±75.45 abA	299.14-494.58	409.29±74.65 aA
Fe	68.98-133.00	87.82±25.83 aA	37.78-110.88	66.07±28.23 aA	47.75-120.79	92.17±33.29 aA
Zn	3.95-27.12	15.95±8.98 aA	4.77-33.01	17.21±9.62 aA	5.55-16.87	9.79±4.62 aA
Mn	7.24-51.91	25.62±15.27 aA	13.36-19.78	16.27±3.06 aA	7.12-25.59	14.04±6.52 aA

Table 2: Amino acid nutritional components analysis of three genotypes *prunus humilis* fruits (mg/100 g, fresh weight basis)

	Small-fruit-type (n = 11)		Medial-fruit-type (n = 11)		Big-fruit-type (n = 11)	
Indices	Scope	Mean±SD	Scope	Mean±SD	Scope	Mean±SD
Asp	295.44-2433.60	1223.85±1023.98 b	777.65-3256.53	1765.28±1140.94 a	800.22-3865.99	1898.16±1320.52 a
Thr	119.19-140.56	137.35±26.65 a	158.78-159.03	158.36±15.58 a	152.21-207.23	166.53±33.83 a
Ser	173.72-217.14	210.13±39.98 a	233.44-277.04	245.32±42.83 a	217.01-276.31	238.08±39.03 a
Glu	343.63-579.34	454.08±156.83 a	510.65-836.58	577.61±205.08 a	554.58-708.65	545.12±115.79 a
Pro	230.78-753.24	483.80±260.35 b	685.73-815.78	804.76±132.40 a	295.37-934.94	594.56±247.19 b
Gly	159.77-267.60	226.53±67.65 a	236.36-317.55	255.71±62.30 a	220.02-310.85	243.29±55.94 a
Ala	150.89-207.23	176.30±46.13 a	200.39-217.39	211.57±16.87 a	197.42-250.11	218.57±35.13 a
Cys	20.29-39.64	27.68±16.40 a	23.34-35.04	27.26±12.98 a	16.58-75.03	36.43±24.72 a
Val	135.68-168.49	152.73±32.80 a	150.02-179.46	172.63±7.79 a	168.78-253.68	191.25±45.54 a
Met	13.95-18.02	15.38±5.13 a	18.97-27.38	23.36±7.79 a	16.58-25.01	20.82±6.51 a
Ile	109.05-120.73	108.65±18.45 a	121.55-135.69	134.99±9.09 a	132.62-159.59	143.11±20.82 a
Leu	185.13-197.32	184.50±30.75 a	201.34-212.43	224.55±31.15 a	236.60-267.98	247.19±29.92 a
Tyr	39.31-94.61	59.45±31.78 a	53.98-60.23	55.81±9.09 a	54.25-85.75	59.85±16.91 a
Phe	103.98-193.72	130.18±49.20 a	110.88-114.98	119.42±16.87 a	132.62-146.49	135.30±15.61 a
His	90.03-124.34	111.73±23.58 a	107.98-164.25	128.50±35.05 a	110.01-169.12	128.80±29.92 a
Lyb	153.43-182.00	177.33±29.73 a	170.70-213.53	185.61±35.05 a	147.69-247.73	184.74±48.14 a
Arg	107.78-109.02	99.43±13.33 a	97.75-102.93	99.95±12.98 a	85.90-120.29	102.78±18.21 a
EAA	815.32-871.27	907.13±138.38 a	911.04-1012.55	1018.93±66.20 a	993.11-1307.72	1087.64±189.95 a
/TAA	2406.66-5025.78	3973.93±1254.60 a	4420.77-6690.45	5159.55±1475.83 a	4332.63-7648.60	5135.05±1786.27 a
E/T /%	---	22.83	---	19.75	---	21.18

Table 3: Three genotypes *Prunus humilis* solitary fruit weight

	Small-fruit-type (n = 11)		Medial-fruit-type (n = 11)		Big-fruit-type (n = 11)	
Indices	Scope	Mean±SD	Scope	Mean±SD	Scope	Mean±SD
Fresh weight /g	1.41-2.00	1.85±0.28 cB	3.05-3.80	3.56±0.28 bB	5.29-10.01	6.42±1.79 aA
Flesh fresh weight /g	1.17-1.85	1.60±0.25 cB	2.78-3.51	3.24±0.26 bB	4.93-9.36	5.93±1.70 aA
Flesh dry weight /g	0.11-0.21	0.16±0.04 cC	0.31-0.49	0.42±0.08 bB	0.61-1.11	0.76±0.18 aA
Moisture content /%	87.32-90.99	89.75±1.51 aA	85.41-89.05	87.02±1.55 bB	84.93-88.09	86.99±1.13 bB

Different capital letters in the same row indicate significant difference ($p<0.01$); Different small letters in the same row indicate significant difference ($p<0.05$); the same below

g. The essential amino acid content accounted 19.75~22.83% of total amino acid. Therefore, wild *Prunus humilis* fruits are rich in all kinds of amino acid and total amino acids and essential amino acids content in big-fruit-type were higher than that of small fruit type.

EXPERIMENTAL

Materials: Chinese dwarf cherry (*Prunus humilis*) were obtained from the wild population of YanShan mountains in Hebei province, north of China, about ten years old. Chinese dwarf cherry *(Prunus humilis*) fruit mature period from late July to early August, fruit shape is oblate or circular or peach, fruit color is pink or red or purple red. According to the morphological differences, divided them into three genotypes, small leaf and small fruit type (small-fruit-type for short, solitary fruit weight 1.00~2.00 g), medial leaf and medial fruit type (medial-fruit-type for short, solitary fruit weight 3.00~4.00 g) and big leaf and big fruit type (big-fruit-type for short, solitary fruit weight 5.00~10.00 g). Each genotype fruit selected 11 plants for gathering the fruits, per plant collection 30 fruits. Fruit quality size was shown in Table 3.

Table 4: Microwave digestion procedure

Steps	Power (w)	Heating-uptime (min)	Working temperature (°C)	Working duration time (min)
1	1400	8	120	10
2	1400	6	160	10
3	1400	6	180	15

Mineral nutrient analysis: Chinese dwarf cherry *(Prunus humilis*) fruits after drying at 65°C, agate mortar grinded and sieved with 60 mesh sieve, accurately weight 0.2500 g placed in Teflon (TFM) sample reaction tank, added 8 mL HNO_3 and soaked overnight. MARS6 microwave digestion instrument (CEM Company/America) was used to digest the samples. The microwave digestion working conditions were shown in Table 4.

After digestion and cooling, transferred the digestion solution to a 25 mL volumetric flask or quantitative colorimetric tube and added deionized water to 25 mL. And then filtration, the filtrate were tested by Optima 2100DV plasma emission spectrometer (American Perkin Elmer Company).

ICP-OES optimal working conditions were determined by orthogonal experiments and the results were as followed: plasma flow rate: 16.0 L/min; auxiliary flow rate: 0.20 L/min; nebulizer flow rate: 0.70 L/min; RF generator power: 1200 w; observation methods: radial; observation height: 15 mm; solution uptake rate: 1.50 mL/min; washing time: 30 s; integral time: 2-5 s.

Amino acid composition analysis: Accurately weighed sample 0.0001 g transferred to a 20 mL hydrolysis tube, added 6 mol/L HCL 10 mL. Then vacuumize the hydrolysis tube and filled with high purity nitrogen after repeated 3 times, sealed. Then put the hydrolysis tube into the (110±1) °C constant temperature drying box, hydrolysis 24 h, cooling and filtering and repeated washing the hydrolysis tube with deionized water, at last the hydrolytic liquid transferred to a 50 mL volumetric flask, constant volume.

Sucked 1 mL filtrate into a vacuum concentrator, added some water, evaporated to dryness, repeat 2 times. And then diluted samples with 1 ml pH 2.2 buffer solution, after dissolved, filtration with the micro porous membrane.

Biochrom 30 automatic amino acid analyzer (USA Ge Corp) analysis was used to determine the amino acids content. Except cysteine 6.25 nmol/50 μ L, the other 16 kinds of amino acids standard sample concentration were 12.5 nmol/50 μ L.

Chromatographic conditions: Ion exchange column: 4.6 mm*20 cm; column temperature: 46, 50, 97°C, respectively visible light detector wavelength: 440 nm (Proline) and 570 nm (the other 16 kinds of amino acids); mobile phase: citric acid and sodium citrate buffer solution; mobile phase flow rate: 35 mL/h; Ninhydrine flow rate: 25 mL/h; analysis time: 50 min.

The values presented in the Table 1, 2 and 3 are mean±Standard Deviation (SD). To determine significant differences among the three genotypes prunus humilis fruits, the results were statistically analyzed using a one-way ANOVA followed by Duncan's multiple range test at the $p<0.05$ significance level.

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