



NOTE

Analysis of Macroelements, Beneficial Trace Elements, Rare Earth Elements in the Wild *Ixeris chinensis* (Thunb.) Nakai by ICP-MS

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Wild China *Ixeris* [*Ixeris chinensis* (Thunb.) Nakai] has Chinese herbal properties and can be used for the treatment for many diseases. But trace element nutrition in wild China *Ixeris* has not been reported, including heavy metals, beneficial elements for human health and rare earth elements. The results showed that the concentrations of macroelements and beneficial trace elements in wild China *Ixeris* are many times higher than those in most vegetables, such as radish, cucumber, garland chrysanthemum, parsley, chives and leek moss, so wild China *Ixeris* is of great significance to complement macroelements and beneficial trace elements for the human health. Rare earth elements in wild China *Ixeris* are at a low level. Some heavy metals in wild China *Ixeris* exceeded the national standard, so before eating the harmful elements in wild China *Ixeris* should be detected.

Key Words: *Ixeris chinensis* (Thunb.) Nakai, Trace elements, Heavy metals, ICP-MS.

Wild China *Ixeris* [*Ixeris chinensis* (Thunb.) Nakai], also called bitter herbs, section prop lotus, the small bitter wheat dish, bitter leaf seedlings, Patrina Ma bitter vegetables, ground squirrel grass, small endive, blood circulation grass trap blood Dan, a small the Kumai, bitter small dishes Kudiezi light leaves Lactuca, Yan'er clothing and Patrinia grass. Wild China *Ixeris* grows in the mountain wilderness and often as field weeds. Wild China *Ixeris* is located in the northern, eastern and southern of China. Wild China *Ixeris* belongs to Lactuca genus of Compositae¹.

Wild China *Ixeris* has Chinese herbal properties of detoxification, cooling consumption carbuncle abscess, stasis and relieve pain, which can be used for the treatment for appendicitis, lung carbuncle high fever, cough vomiting blood and pus, heat canker boil furuncle pain swelling, chest and abdominal pain, appendicitis, enteritis, dysentery, postpartum abdominal pain, dysmenorrhea, etc.¹.

Aboveground part of wild China *Ixeris* contains Sonchus glycosides A, B, C and D, glucoza-luzanin C, macrolininside A, crepidiaside A and picriside) B, C; also contains cinaroside, hyperoside, linarin, apigenin, quercetin and kaempferol; likewise luteolin, quercimeritrin, isocynaroside, 7- β -D-glucuronopyranoside. Seed oil of wild China *Ixeris* contains 13.7 % vernolic acid. Leaf of wild China *Ixeris* contains vitamin C^{1,2}.

Trace element nutrition in wild China *Ixeris* has not been reported, including heavy metals, beneficial elements for human health and rare earth elements. The goal of this work is to study the nutritional and safety characteristics of elements to provide basis of food development of wild China *Ixeris*.

Wild China *Ixeris* [*Ixeris chinensis* (Thunb.) Nakai] were collected from Huairou district of Beijing city. The samples were washed with deionized water, grinded, digested concentrated nitric acid and 30 % H₂O₂ solution, finally determined by ICP-MS, the ICP-MS instrument is Thermo-X7 produced by Thermo Electron Corporation of USA.

Macroelements in wild China *Ixeris*: The results show that wild China *Ixeris* contain much Mg, P, K, Ca and Mn (Table-1), whose concentrations are many times higher than those in vegetables radish, cucumber, garland chrysanthemum, parsley, chives and leek moss, so wild China *Ixeris* is of great significance to complement the macroelements in the human body³. The results are consistent to the former results⁴.

Beneficial trace elements in wild China *Ixeris*: In beneficial trace elements, content of Zn in wild China *Ixeris* is much higher than that in vegetables radish, cucumber, garland chrysanthemum, parsley, chives, leek moss, so wild China *Ixeris* can supplement Zn for human body. In addition to zinc, the wild China *Ixeris* also contain many other beneficial trace elements, such as I, Se, Mo, Sr, Rb, Li and Co (Table-2), which are few reported in leafy vegetables. The descending order of

TABLE-1
CONCENTRATIONS OF SEVEN KINDS OF
MACROELEMENTS IN WILD CHINA IXERIS (ng/g)

Elements	Concentration	Elements	Concentration
Mg	1640115.41	Ca	8094053.76
Si	178976.32	Mn	31012.69
P	4475560.05	Fe	133069.54
K	12133185.95	–	–

TABLE-2
CONCENTRATIONS OF EIGHT KINDS OF BENEFICIAL
TRACE ELEMENTS IN WILD CHINA IXERIS (ng/g)

Elements	Concentration	Elements	Concentration
Li	959.73	Se	884.79
I	1376.40	Rb	2678.36
Co	112.91	Sr	25293.27
Zn	21643.69	Mo	593.03

beneficial trace elements in wild China Ixeris is $Sr > Zn > Rb > I > Li > Se > Mo > Co$.

Harmful trace elements in wild China Ixeris: Heavy metals and harmful elements, as important indicators of food safety, were also determined in wild China Ixeris. The results showed that wild China Ixeris contained much Pb, Al, Cu and Ni, compared with national standards (GB 2762-2005), Pb, As in wild China Ixeris exceeded the national standard and the contents of Cd, Cr, Hg were lower than national standard, which should be relative to the heavy metals content in soil and growth cycle of wild vegetable. So before eating the harmful elements in wild China Ixeris should be detected⁵. In addition to heavy metals in standards, Al, Ti, Cu content in wild China Ixeris are also very high (Table-3), which also should arouse our attention.

TABLE-3
CONCENTRATIONS OF TWELVE KINDS OF HARMFUL
TRACE ELEMENTS IN WILD CHINA IXERIS (ng/g)

Elements	Concentration	Elements	Concentration
Al	90564.05	Hg	0.00
V	287.27	Tl	7.99
Cr	280.78	Pb	443.15
Ni	794.86	Cd	179.36
Cu	8892.89	Sn	24.98
As	70.44	Sb	16.49

Rare earth elements in wild China Ixeris: Rare earth elements in food have been reported the last several years, most researches proved that the trace rare earth elements were beneficial to humans, but too much rare earth elements were harmful^{6,7}. The results in this study proved that rare earth elements in wild China Ixeris are at a low level (Table-4).

Other trace elements whose biological function are unknown in wild China Ixeris: This experiment also determined the other elements in wild China Ixeris, including Be, Ga, Ge, Ti, Br, Nb, Cs, Ba, W, Os, Au, Rh, Pd, Bi, Th and U (Table-5). Although there is no direct evidence that these elements are related to human health and disease, we hope that these data can provide basal data for the future development of the wild China Ixeris.

TABLE-4
CONCENTRATIONS OF RARE EARTH
ELEMENTS IN WILD CHINA IXERIS (ng/g)

Elements	Concentration	Elements	Concentration
La	78.44	Dy	9.49
Ce	168.86	Ho	2.00
Pr	19.48	Er	3.00
Nd	71.44	Tm	0.50
Sm	14.99	Yb	2.00
Eu	6.49	Lu	1.00
Gd	10.99	Sc	112.41
Tb	2.50	Y	37.47

TABLE-5
CONCENTRATIONS OF OTHER TRACE ELEMENTS
WHOSE BIOLOGICAL FUNCTION ARE UNKNOWN
IN WILD CHINA IXERIS (ng/g)

Elements	Concentration	Elements	Concentration
Be	5.00	W	28.48
Ga	46.46	Os	0.50
Ge	0.50	Au	1.00
Ti	21786.07	Rh	29.48
Br	2066.35	Pd	2.50
Nb	14.49	Bi	9.49
Cs	23.48	Th	22.98
Ba	30235.81	U	8.49

Conclusion

(i) The concentrations of macroelements and beneficial trace elements in wild China are many times higher than those in most vegetables, such as radish, cucumber, garland chrysanthemum, parsley, chives and leek moss, so wild China Ixeris is of great significance to complement macroelements and beneficial trace elements for the human health.

(ii) Rare earth elements in wild China Ixeris are at a low level.

(iii) Some heavy metals in wild China Ixeris exceeded the national standard, so before eating the harmful elements in wild China Ixeris should be detected.

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