Contents of mineral elements in two traditional Tibetan medicines *Fritillaria ussuriensis* and *Gastrodia elata*

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**KEYWORDS**
- Traditional Tibetan medicines; *Fritillaria ussuriensis*; *Gastrodia elata*;
- ICP-MS (inductively coupled plasma mass spectrometry);
- Mineral elements

**Abstract**

The contents of mineral elements in wild traditional Tibetan medicines *Fritillaria ussuriensis* and *Gastrodia elata* from Tibet were determined by ICP-MS to study their efficacy mechanism and quality. The results showed that wild *Gastrodia elata* contained more Ca, Fe and Mn than *F. ussuriensis*, and less Zn, which proved that different traditional Tibetan medicines had different abilities to absorb mineral elements, which should be relative to their efficacy. Compared with *F. ussuriensis*, *Gastrodia elata* contained more Pb, Cr and Se, and less Cd and As. Referred to relative standards, toxic elements’ content in *Gastrodia elata* is not excessive, but Cd in *F. ussuriensis* was much higher than that of standard.

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**1. Introduction**

*Fritillaria ussuriensis* belongs to Liliaceae family and *Fritillaria* species is a perennial medicinal herb, which has a good effect for the treatment of cough, phlegm, chest tightness, bronchitis and chronic bronchitis (Zhang et al., 2010; Li et al., 2010). *Gastrodia elata* belongs to Orchidaceae family and *Gastrodia* species is also a perennial medicinal herb, whose effects as medicine are to treat dizziness, headache, epilepsy, rheumatism and paralysis (Zheng et al., 1997).

Most researches were focused on organic compounds in traditional Tibetan medicines, which were considered to be the main active ingredients, such as peimine and peiminine in *F. ussuriensis* (Zhang et al., 2009) and Gastrodine in *G. elata* (Huang et al., 2011). But mineral elements were important for preventing and treating diseases. Calcium has an important role on human bone development and maintaining the normal physiological function of human heart (Zhang, 1978). Iron plays a very important physiological role in participating in the transportation and storage of oxygen, in participating in combination of cytochromes and various metal enzymes (Sun and Guo, 2011). Manganese, zinc and copper also have important roles to maintain the normal physiological function of human body (Ao, 2008). Many research showed that mineral elements’ contents in medical herbs have a correlation with their effect (Liu and Wu, 2010; Zhuo, 2010). So mineral elements were detected in wild traditional Tibetan medicines *F. ussuriensis* and *G. elata* from Tibet, which will be the first...
time to systematically research the relative of the effect of traditional Tibetan medicines to mineral elements.

2. Materials and methods

Treatments of the samples: Wild traditional Tibetan medicines dry bulb of F. ussuriensis and dry root of G. elata were collected from Tibetan Autonomous Region of China. All the medicines were washed with distilled water to remove the dust, washed with deionized water 3–5 times, air-dried and grinded with stainless steel grinder.

Apparatus: Inductively coupled plasma mass spectrometry apparatus (ELAN DRCII).

The parameters of instruments and the extracting methods referred to reference (Rui et al., 2009). Weighed samples 0.5 g precisely, digested with 1.5 mL HNO3 and 0.5 mL H2O2, diluted to 10 mL.

The digestion procedure: 150 °C for 15 min at 500 W power, 200 °C for 20 min at 800 W power and 100 °C for 10 min at 400 W power. The solutions were subjected to analysis.

Parameters of ICP: Power, 1250 W; rate of flow of cooling gas (Ar), 15.0 L/min; rate of flow of supplemental gas (Ar), 0.95 L/min.

Parameters of MS: Vacuum of analysis room, 5.89 × 10-6 Torr; impulse voltage, 950 V.

Parameters of detecting: Resolution (10% peak height); 0.8 amu (Nor), 0.6 amu (H); retention period, 50 ms; 3 times of replication; 10 times of circulation; period of analysis, 1.00 min; rate of sample, 1 mL/min.

3. Results and discussion

The results in Table 1 showed that wild F. ussuriensis and G. elata contained many kinds of mineral elements, including Ca, Fe, Mn, Zn and Cu. G. elata contained more Ca, Fe and Mn than F. ussuriensis, which could prove that Ca, Fe and Mn were helpful to treat dizziness, headache, epilepsy, rheumatism and paralysis. F. ussuriensis contained more Zn, so Zn could be relative to treat these diseases cough, phlegm, chest tightness, bronchitis and chronic bronchitis. All these data also proved that different traditional Tibetan medicines had different abilities to absorb mineral elements, which should be relative to their efficacy.

The results showed that F. ussuriensis and G. elata contained much toxic elements, such as As, Cd, Pb, Cr and Se. Compared with F. ussuriensis, G. elata contained more Pb, Cr and Se, and less Cd and As (see Table 2). Referred to relative standards, Toxic elements’ content in G. elata was not excessive, but Cd in F. ussuriensis was much higher than that of standard (Table 3) (Ministry of Foreign Trade and Economic Cooperation of China, 2001; Ministry of Health of the People’s Republic of China, 2005, 2007).

4. Conclusions

(1) There are differences from the content of mineral elements between the two Tibetan medicines under the same soil and environmental condition, which could be the reasons why they have different treatments for many diseases.

(2) On the other hand, usually people think that Tibet is the least polluted place, but the safety of products still requires rigorous testing.

Acknowledgements

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References


Table 1

<table>
<thead>
<tr>
<th>Elements</th>
<th>Fritillaria ussuriensis (μg/g)</th>
<th>Gastrodia elata (μg/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca</td>
<td>355.76</td>
<td>1415.34</td>
</tr>
<tr>
<td>Fe</td>
<td>103.88</td>
<td>126.15</td>
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<tr>
<td>Zn</td>
<td>31.54</td>
<td>10.64</td>
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<tr>
<td>Mn</td>
<td>12.91</td>
<td>30.09</td>
</tr>
<tr>
<td>Cu</td>
<td>3.44</td>
<td>3.42</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Elements</th>
<th>Fritillaria ussuriensis (μg/g)</th>
<th>Gastrodia elata (μg/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>As</td>
<td>0.11</td>
<td>0.10</td>
</tr>
<tr>
<td>Cd</td>
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<td>0.14</td>
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<tr>
<td>Pb</td>
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<tr>
<td>Cr</td>
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<td>0.48</td>
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<tr>
<td>Se</td>
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Table 3

<table>
<thead>
<tr>
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<th>Se</th>
<th>Cd</th>
<th>Pb</th>
<th>Cr</th>
</tr>
</thead>
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<td>0.3</td>
<td>5.0</td>
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