Quality Standard of Tibetan Medicine *Nardostachys jatamansi* Herba Based on "An Integrated Plant but Multi-purpose"

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Abstract [**Objectives**] To establish the quality standard of *Nardostachys jatamansi* Herba. [**Methods**] The characters and microscopical identification of *N. jatamansi* Herba were carried out. The contents of moisture, total ash, acid-insoluble ash and extract were determined according to the relevant methods of the *Chinese Pharmacopoeia* (2020 edition). Using chlorogenic acid and 3, 5-O-dicaffeoylquinic acid as quality control indexes, TLC and HPLC methods were established for qualitative and quantitative determination, and HPLC fingerprints were established. [**Results**] The characteristics of character identification, microscopic identification and thin layer identification were obvious. The moisture content ranged from 2.7% to 7.8%, with an average value of 5.4%. The total ash content ranged from 6.7% to 16.2%, with an average of 11.0%. The acid-insoluble ash content ranged from 0.7% to 8.5%, with an average of 3.6%. Extractives content ranged from 20.9% to 34.4%, with an average of 29.7%. Chlorogenic acid content was between 0.45% and 1.30%, with an average value of 0.77%. The content of 3, 5-O-dicaffeoylquinic acid ranged from 0.18% to 0.58%, with an average of 0.31%. The similarity of each batch was between 0.930 and 0.994, indicating that the quality of medicinal materials from different producing areas was stable. [**Conclusions**] The quality standard of *N. jatamansi* Herba was established, which could provide quality control basis for rational, comprehensive and efficient utilization of *N. jatamansi* DC. resources and clinical use.

Key words *Nardostachys jatamansi* Herba, Chlorogenic acid, 3, 5-O-dicaffeoylquinic acid, Fingerprint, Quality standard, Resource utilization

1 Introduction

Nardostachys jatamansi DC., a plant of Valerianaceae, is a rare and endangered medicinal plant on the Qinghai - Tibet Plateau. It was first recorded in the *Supplement to the Compendium of Materia Medica*[1] and has been recorded in the *Compendium of Materia Medica*, the *Jingzhu Materia Medica*, the *Four Medical Tantras*, the *Tibetan Medicine Chronicles*, the *Blue Glaze*, and other books. The traditional medicine habit is to use roots and rhizomes (underground parts), while stems and leaves, which account for more than 30% of the total plant biomass, are usually abandoned and not used. The "Bangbei" used in Tibetan medicine is mostly the dry roots and rhizomes of *N. jatamansi* DC[2-7]. The *Sichuan Provincial Standard for Traditional Chinese Medicine* (1987 edition), the *Chinese Pharmacopoeia* (1963 edition, 1977 edition, 1990 - 2020 edition), and the current *Hong Kong Standard for Traditional Chinese Medicine* (sixth issue) have all established medicinal standards based on the "roots and rhizomes" of *N. jatamansi* DC. The *Quality Standards for Traditional Chinese Medicine and Ethnic Medicinal Materials in Guizhou Province* (2003 edition) have established the standard for "*N. jatamansi* DC. Oil (pine root oil)".

Through literature review and market research, it has been found that *N. jatamansi* DC. has a habit of using whole herbs and aboveground parts as medicine. For example, the *Chinese Materia Medica* (Tibetan Medicine Volume) records that *N. jatamansi* DC. uses whole herbs as medicine[8]; the prescription "Anzhong Pill" recorded in the *Chengshu* (Volume 12) uses the leaves of *N. jatamansi* DC. as medicine[9]. Modern research results[10-12] indicate that the chemical composition and pharmacological effects of different medicinal parts of *N. jatamansi* DC. differ and cannot be replaced by each other. Therefore, based on clinical medication habits, the newly established quality standards for leaves of *N. jatamansi* DC. (aboveground parts) can provide a basis for the comprehensive utilization and clinical use of *N. jatamansi* DC. resources.

2 Materials

2.1 Instruments Waters 2695 high-performance liquid chromatograph (USA Waters Company); Agilent C_{18} chromatographic column (250 mm × 4.6 mm, 5 μm); ME104/02 1/10 000 electronic analytical balance (Mettler-Toledo Instrument Shanghai Co., Ltd.); ME55/02 1/100 000 electronic analytical balance (Mettler-Toledo Instrument Shanghai Co., Ltd.); OLYMPUS BX41 biological microscope (Japan OLYMPUS Company); CAMAG thin-layer scanning chromatograph (Switzerland CAMAG Company); thin-layer chromatography silica gel G plate (Qingdao Hailang Silicone Desiccant Factory).

2.2 Reagents FAA fixed liquid (90 mL of 70% ethanol solution, 5 mL of formalin, 5 mL of glacial acetic acid), hydrated chloral, dilute glycerol; chlorogenic acid (lot No.: 110753-201817, mass fraction > 98%), 3, 5-O-dicaffeoylquinic acid

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(lot No.:111782-201807, mass fraction >98%), were all bought from Chengdu Pufeide Biotechnology Co., Ltd. Ethanol, methanol (AR), acetonitrile (chromatographic purity), distilled water.

2.3 Source of raw materials Leaves of *N. jatamansi* DC. (aboveground parts) were collected from Tibetan areas such as Sichuan, Qinghai, and Gansu. According to Professor Liu Yuan from the Qinghai – Tibet Plateau Research Institute of Southwest Minzu University, it has been identified as a plant of Valerianaceae, *N. jatamansi* DC. Fresh whole plants of *N. jatamansi* DC. were collected, and sediment and weeds were removed. They were placed in a ventilated area for natural shade drying. After removing underground parts, they were cut into sections and crushed. Then, it passed through No. 3 sieve, and was stored in a cool and dry place. The source information of the samples was shown in Table 1.

Table 1 Information on the source of *Nardostachys jatamansi* Herba sample

No.	Collection site	Longitude//E	Latitude// N	Altitude//m	Collection time	Type
S1	① (transplanted in 2015)	102°35′00″	32°50′07″	3 490	2019 – 07 – 07	A
S2	① (transplanted in 2015)	102°35′00″	32°50′07″	3 490	2020 – 05 – 21	A
S3	① (transplanted in 2016)	102°35′01″	32°50′08″	3 491	2020 – 05 – 21	A
S4	① (transplanted in 2017, without weeding)	102°35′02″	32°50′09″	3 492	2020 – 05 – 21	A
S5	① (transplanted in 2017)	102°35′03″	32°50′10″	3 493	2020 – 05 – 21	A
S6	②	–	–	–	2020 – 05 – 20	B
S7	③	102°27′06″	32°44′52″	3 561	2019 – 07 – 07	B
S8	④	102°44′11″	32°55′24″	3 560	2019 – 07 – 08	B
S9	⑤	102°49′05″	33°04′24″	3 610	2019 – 07 – 08	B
S10	⑥	102°37′18″	33°26′24″	3 503	2019 – 07 – 09	B
S11	⑦	103°03′22″	33°29′02″	3 484	2019 – 07 – 09	B
S12	⑦	103°08′55″	33°22′46″	3 548	2019 – 07 – 09	B
S13	⑧	101°49′36″	34°36′12″	3 610	2019 – 07 – 10	B
S14	⑨	102°09′13″	34°27′11″	3 530	2019 – 07 – 10	B
S15	⑩	101°16′58″	33°23′36″	3 930	2019 – 07 – 11	B
S16	⑪	101°02′41″	33°25′59″	4 130	2019 – 07 – 11	B
S17	⑫	101°45′24″	34°03′45″	3 430	2019 – 07 – 11	B
S18	⑬	101°55′05″	33°53′06″	3 520	2019 – 07 – 11	B

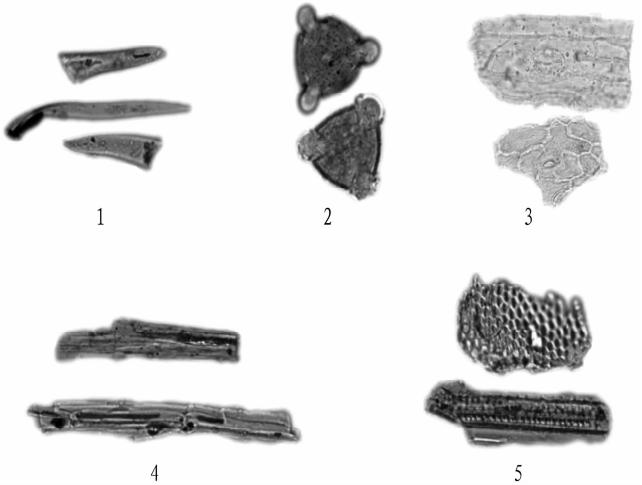
NOTE ① Qinghai – Tibet Base of Southwest Minzu University in Qiongxi Town, Hongyuan County; ② – ⑤ are respectively Amu Township, Anxia Halama Village of Anqu Town, Ezha Village of Amu Township, Maiwa Village One of Maiwa Township in Hongyuan County, Aba Prefecture, Sichuan Province; ⑥ – ⑦ are respectively Ese Village and Jiangdong Village of Ruoergai County, Aba Prefecture, Sichuan Province; ⑧ – ⑨ are respectively Youganning Town and Saierlong Township of Henan County, Huangnan Prefecture, Qinghai Province; ⑩ – ⑪ are respectively Guojiang Village of Zhiqing Songduo Town and Suohu Rima Township in Jiuzhi County, Guoluo Prefecture, Qinghai Province; ⑫ – ⑬ are respectively Oula Town and Ouqiang Village of Maqu County, Gannan Prefecture, Gansu Province. A. Imitation of wild products; B. Wild products.

3 Methods and results

3.1 Microscopic identification The powder of this product is light yellow or brownish yellow. There are many non-glandular hairs, which are conical or strip-shaped, often broken, with a microwave like outer skin and longitudinal texture on the surface. Pollen grains are round in shape, with round grain like carvings on the surface and three germination pores. The epidermal cells of the leaves are tightly arranged, generally rectangular in shape and distributed with stomata. Stomata are more common, with an indefinite pattern and 4 – 6 accessory cells. Wood fibers form bundles and often break. Threaded vessels are more common, and occasionally with bordered pit vessels (Fig. 1).

3.2 Thin-layer chromatography identification

3.2.1 Preparation of test solution. 0.2 g of this product powder was taken, and 10 mL of 70% methanol was added. After ultrasonic treatment for 30 min, it was filtered. The filtrate was evaporated, and 1 mL of methanol was added for solution, and it was used as the test solution.

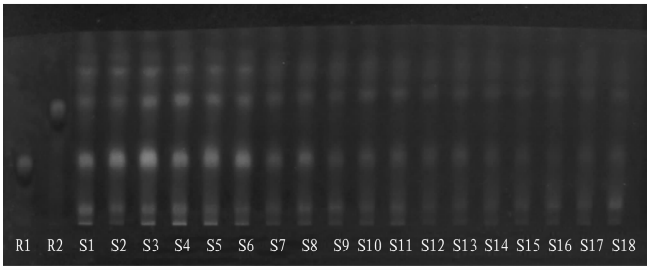


NOTE 1. Non-glandular hairs; 2. Pollen grains; 3. Epidermis cells and stomata apparatus; 4. Wood fiber; 5. Bordered pit vessels and threaded vessels.

Fig. 1 Microscopic characteristics of *Nardostachys jatamansi* Herba

3.2.2 Preparation of reference solution. An appropriate amount of chlorogenic acid and 3, 5-O-dicaffeoylquinic acid standard were accurately weighed, and 1.0 mg/mL of solution was prepared using the same method as the reference solution.

3.2.3 Thin-layer conditions and inspection. Butyl acetate∶formic acid∶methanol (7∶1∶1) was used as the development system, and it was viewed at a wavelength of 365 nm. In the chromatography of test sample, spots of the same color were observed in the corresponding positions of chlorogenic acid and 3, 5-O-dicaffeoylquinic acid, and R_f value of the target spot was moderate. The thin-layer chromatogram was shown in Fig. 2.



NOTE R1. Chlorogenic acid reference solution; R2. 3, 5-O-dicaffeoylquinic acid reference solution; S1-S18. Test solution.

Fig. 2 Thin-layer chromatography of *Nardostachys jatamansi* Herba

3.3 Measurement of inspection items The determination of moisture referred to the toluene method under General Rule 0832 of the *Chinese Pharmacopoeia* (2015 edition); the determination of total ash and acid insoluble ash referred to General Rule 2302 of the *Chinese Pharmacopoeia* (2015 edition). The moisture content of the aboveground parts of 18 batches of *N. jatamansi* DC. ranged from 2.7% to 7.8%, with an average of 5.4%; the total ash content ranged from 6.7% to 16.2%, with an average of 11.0%; the content of acid insoluble ash ranged from 0.7% to 8.5%, with an average of 3.6%. The results were shown in Table 2.

3.4 Determination of extract content 2 g of *N. jatamansi* Herba (aboveground part) powder was accurately weighed. According to the 2020 edition of the *Chinese Pharmacopoeia* (General Rule 2201 of the Volume IV) and relevant literature[13], the content of the extract was determined. The result showed that the content of the extract was between 20.9% and 34.4%, with an average of 29.7% (Table 2).

3.5 Content determination

3.5.1 Chromatographic conditions. Chromatographic column: Agilent C_{18} (250 mm×4.6 mm, 5 μm); mobile phase: acetonitrile (A) -0.1% phosphoric acid solution (B) (gradient elution, the program was shown in Table 3); detection wavelength of content determination: 327 nm, detection wavelength of fingerprint spectrum: 254 nm; flow velocity: 1.0 mL/min; column temperature: 30 ℃; injection volume: 10 μL. The theoretical number of plates should not be less than 3 000 based on the peak of chlorogenic acid. The chromatograms of the test solution and the reference solution were shown in Fig. 3.

Table 2 Determination results of moisture, ash and extract of *Nardostachys jatamansi* Herba %

Batch	Moisture	Total ash content	Acid insoluble ash	Extract content
S1	5.8	10.2	4.5	29.3
S2	4.8	12.1	3.3	20.9
S3	2.8	12.8	5.4	23.2
S4	2.7	12.4	5.2	29.2
S5	4.4	12.8	5.2	33.9
S6	3.1	12.8	5.3	34.4
S7	5.8	12.0	4.7	27.2
S8	7.2	9.5	1.7	32.5
S9	6.5	12.7	1.1	32.0
S10	6.2	7.8	1.0	31.7
S11	6.8	6.7	0.7	29.1
S12	6.6	8.7	2.9	33.4
S13	7.8	7.7	1.0	33.0
S14	5.5	9.9	2.1	31.3
S15	5.2	9.7	2.7	34.0
S16	5.0	10.5	3.7	32.2
S17	5.3	12.8	6.4	28.7
S18	5.5	16.2	8.5	27.1
Min	2.7	6.7	0.7	20.9
Max	7.8	16.2	8.5	34.4
Mean	5.4	11.0	3.6	29.7

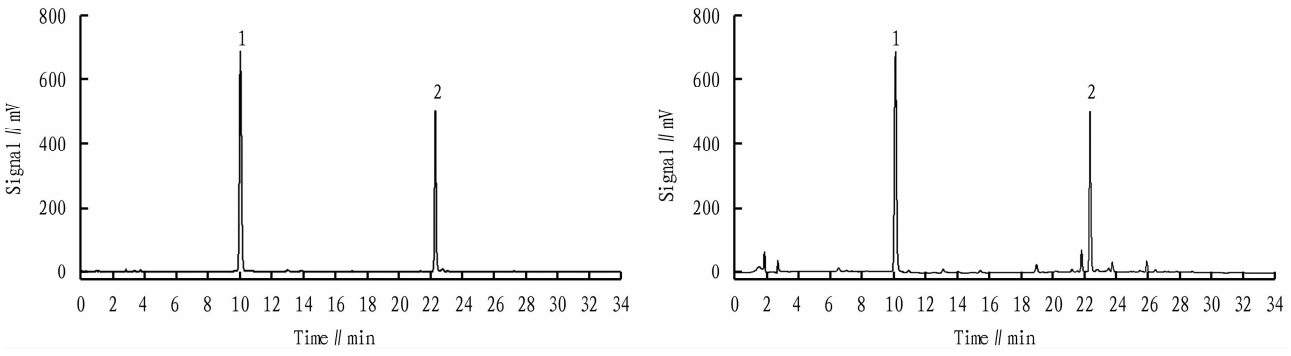
Table 3 Elution procedure

Time// min	Mobile phase *A*	Mobile phase *B*
0 - 15	10→20	90→80
15 - 25	20→40	80→60
25 - 30	40	60
30 - 35	40→10	60→90

3.5.2 Preparation of reference solution. An appropriate amount of chlorogenic acid and 3, 5-O-dicaffeoylquinic acid reference substances were accurately weighed and placed in a brown volumetric flask. After adding 70% methanol, the mixed reference solution containing 50 μg chlorogenic acid and 20 μg 3, 5-O-dicaffeoylquinic acid per 1 mL was obtained.

3.5.3 Preparation of test solution. 0.5 g of *N. jatamansi* Herba powder (passed through No. 3 sieve) was weighed accurately and placed in a conical flask with a stopper. After adding 50 mL of 70% methanol precisely, it was weighed, and ultrasonic extraction (50 W of power, 40 kHz of frequency) was performed for 30 min. After cooling, it was weighed again, and 70% methanol was used to make up for the lost weight. Then, it was shaken well and filtered, and the remaining filtrate was used as test solution.

3.5.4 Linear relationship examination. An appropriate amount of chlorogenic acid and 3, 5-O-dicaffeoylquinic acid were taken, and 70% methanol was added to prepare a mixed reference solution containing 1.084 mg/mL of chlorogenic acid and 0.505 mg/mL 3,5-O-dicaffeoylquinic acid. After shaken well, the mixed reference solution was obtained. 1 mL of mixed reference solution was taken and gradually diluted by 5 times to obtain a series of mixed standard solutions (chlorogenic acid solution: 1.084, 0.217,



NOTE 1. Chlorogenic acid reference; 2. The 3, 5-O-dicaffeoylquinic acid reference.

Fig. 3 HPLC chromatograms of reference solution (I) and test solution (II)

0.043, 0.009, 0.002 mg/mL; 3, 5-O-dicaffeoylquinic acid solution: 0.505, 0.101, 0.020, 0.004, 0.001 mg/mL). After injecting into the liquid chromatograph, the peak area was recorded, and regression was performed with the peak area as the *y*-axis (*Y*) and the concentration (mg/mL) as the *x*-axis (*X*). The regression equation and linear range were shown in Table 4. The results showed that when the concentration of chlorogenic acid was between 0.002 and 1.084 mg/mL, there was a good linear relationship with the peak area; when the concentration of 3, 5-O-dicaffeoylquinic acid was between 0.001 and 0.505 mg/mL, there was a good linear relationship with peak area.

Table 4 Regression equation and linear range

Component	Regression equation	R^2	Linear range // mg/mL
Chlorogenic acid	$Y = 3 \times 10^7 X + 121\ 341$	0.999 8	0.002 – 1.084
3, 5-O-dicaffeoylquinic acid	$Y = 3 \times 10^7 X - 13\ 270$	0.999 9	0.001 – 0.505

3.5.5 Precision test. 10 μL of mixed reference solution was precisely measured, and the sample was injected for 6 times continuously. The peak area of the chromatography was recorded, and the *RSD* values of the peak areas of chlorogenic acid and 3, 5-O-dicaffeoylquinic acid were calculated, which were 0.84% and 0.56%, respectively, indicating that the injection precision of this method was good.

3.5.6 Repetitive testing. 0.5 g of *N. jatamansi* Herba powder (lot No.: S2) was weighed accurately, 6 portions in total. According to the method in Section **3.5.3**, the test solution was prepared. Under the above chromatographic conditions, measurement was conducted, and the peak area of the chromatography was recorded. The *RSD* values of chlorogenic acid and 3, 5-O-dicaffeoylquinic acid contents were calculated, which were 1.91% and 2.39%, respectively, indicating good repeatability of this method.

3.5.7 Stability test. According to the above chromatographic conditions, the reference solution and the test solution were taken and injected into the liquid chromatograph at 0, 6, 12, 18, 24, and 48 h. The peak areas of chlorogenic acid and 3, 5-O-dicaffeoylquinic acid were recorded, with *RSD* values of 3.27% and 1.21%, respectively, indicating good reproducibility of this method.

3.5.8 Sample recovery rate test. 0.25 g of *N. jatamansi* Herba powder with known content (S2, 6.54 mg/g of chlorogenic acid and 1.77 mg/g of 3, 5-O-dicaffeoylquinic acid) was accurately weighed, a total of 9 portions. Standard samples were added at low, medium, and high levels (chlorogenic acid content was 1.310 0, 1.635 0, and 1.964 5 mg; 3, 5-O-dicaffeoylquinic acid content was 0.354 0, 0.442 5, and 0.531 0 mg). According to the proposed method, the test solution was prepared and determined, and the recovery rate was calculated according to the following formula. The results showed that the recovery rates of chlorogenic acid and 3, 5-O-dicaffeoylquinic acid were 99.13% and 98.03%, respectively, with *RSD* of 1.65% and 2.08%, indicating good accuracy of this method.

Recovery rate = [Measured amount (mg) – Amount of reference substance in the sample (mg)/Added reference substance (mg)] × 100%

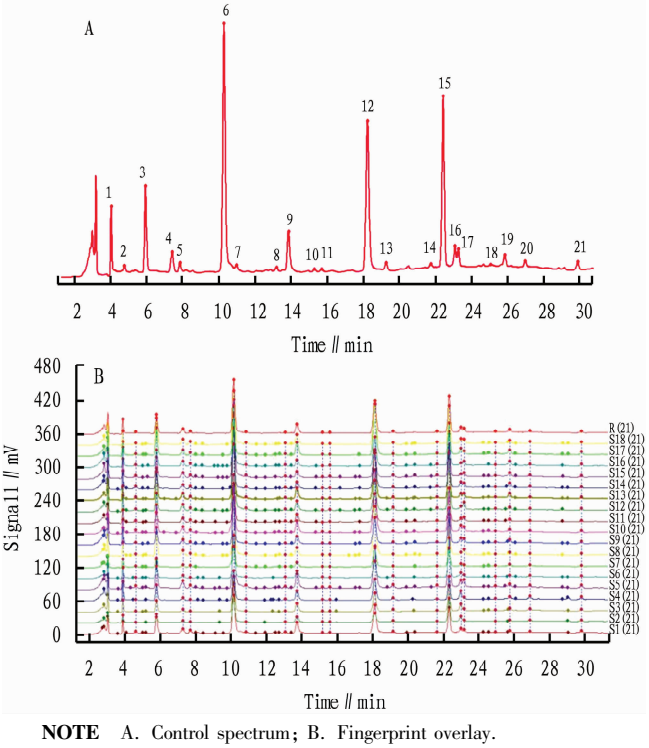
3.5.9 Sample determination. Each batch of sample powder was accurately weighed, with three times of parallelism. According to Section **3.5.3**, the test solution was prepared and measured under the above chromatographic conditions. The results were shown in Table 5. The content of chlorogenic acid ranged from 0.45% to 1.30%, with an average value of 0.77%; the content of 3, 5-O-dicaffeoylquinic acid ranged from 0.18% to 0.58%, with an average of 0.31%. The measurement results showed that the contents of chlorogenic acid and 3, 5-O-dicaffeoylquinic acid in the aboveground parts of different batches of *N. jatamansi* DC. fluctuated greatly. According to the calculation of dry products, the content of chlorogenic acid in the aboveground parts of *N. jatamansi* DC. was tentatively not less than 0.45%, and the content of 3,5-O-dicaffeoylquinic acid was not less than 0.14%.

3.5.10 Establishment of HPLC fingerprint spectra and similarity evaluation. The HPLC raw data (AIA format) of 18 batches of *N. jatamansi* DC. aboveground samples were import into the *Similarity Evaluation System for Chromatographic Fingerprint of TCM* (2012 version A) to establish fingerprint spectra and calculate the similarity of each batch. Using S1 as a reference graph, a median was used, and time window width was 0.5. Multiple-point correction was performed to match the Mark peaks. A total of 21 common peaks were identified (Fig. 4), and No. 6 peak and No. 15 peak

Table 5 Results of HPLC determination %

Batch	Chlorogenic acid content	3, 5-O-dicaffeoylquinic acid
S1	0.65	0.18
S2	0.57	0.25
S3	0.55	0.19
S4	0.80	0.24
S5	0.56	0.23
S6	1.08	0.58
S7	0.45	0.19
S8	1.04	0.39
S9	0.62	0.28
S10	0.63	0.36
S11	0.62	0.26
S12	1.30	0.56
S13	1.15	0.40
S14	0.57	0.26
S15	1.08	0.29
S16	0.86	0.28
S17	0.56	0.25
S18	0.73	0.32
Min	0.45	0.18
Max	1.30	0.58
Mean	0.77	0.31

were chlorogenic acid and 3,5-O-dicaffeoylquinic acid, respectively. The similarity results (Table 6) showed that the similarity of 18 batches of samples was between 0.930 and 0.994, indicating that the quality of each batch of medicinal materials was stable.



NOTE A. Control spectrum; B. Fingerprint overlay.

Fig. 4 HPLC fingerprint of 18 batches of samples

Table 6 Similarity results of 18 batches of samples

No.	Similarity	No.	Similarity	No.	Similarity
S1	0.993	S7	0.983	S13	0.996
S2	0.961	S8	0.989	S14	0.989
S3	0.994	S9	0.999	S15	0.966
S4	0.981	S10	0.960	S16	0.991
S5	0.990	S11	0.996	S17	0.930
S6	0.971	S12	0.971	S18	0.994

4 Discussion

"Integrated but multi-purpose" refers to that different tissue parts of a plant or animal have similar or differentiated effects. When the difference is large enough, they can be broken down into multiple drugs, making them more adaptable to the ever-changing disease conditions[14]. The "integrated but multi-purpose" of drugs is a better way to discover new drugs, expand medicinal parts, and comprehensively utilize medicinal resources[14]. Throughout the history of Chinese herbal medicine, the concept of "integrated but multi-purpose" has universality in traditional Chinese medicine, with typical examples such as Angelica sinensis[15]. With the maturity and promotion of mass spectrometry technologies such as UPLC-Q-TOF-MS/MS and GC-MS in recent years, combined with the development status of traditional Chinese medicine resources, researchers have conducted in-depth research on the dynamic accumulation patterns of active ingredients in medicinal parts of traditional Chinese medicine and the chemical composition of non medicinal parts[16]. Multiple varieties of traditional Chinese medicine have formed new medicinal materials based on "integrated but multi-purpose", such as Cortex Eucommiae and *Eucommia ulmoides* leaves[17], Herba Schizonepetae and *Nepeta cataria* L. spike[18], Kusnezoff Monkshood Root and *Aconitum kusnezoffii* leaves[19], Ginseng Radix Et Rhizoma and *Panax ginseng* leaves[20], *Perilla frutescens* leaves and *P. frutescens stems*[21]. This not only reflects the idea of scientific development and utilization of traditional Chinese medicine resources, but also meets the needs of different clinical drugs. Different parts of the same plant usually contain the same or similar chemical components and physiological activities, usually only differences in content and efficacy[22]. The research group also conducted UPLC fingerprinting and pharmacological comparison studies on the aboveground and underground parts of *N. jatamansi* DC., and found that the chemical components of the two were roughly similar, but the content differences were significant; the roots and rhizomes (underground parts) of *N. jatamansi* DC. mainly contain terpenoids such as nardosinone, which have effects such as antidepressant and antiarrhythmic effects[23-25]. *N. jatamansi* DC. leaves (aboveground parts) mainly contain phenylpropanoid compounds such as chlorogenic acid and 3, 5-O-dicaffeoylquinic acid, and have good anti-inflammatory and antibacterial pharmacological activities.

Therefore, based on the understanding of "integrated but multi-purpose" of *N. jatamansi* DC., a quality standard for *N. jatamansi* DC. leaves was established in this paper. According to the naming principles of the *Chinese Pharmacopoeia*, the medicinal herb was named "*N. jatamansi* Herba". In addition to routine

inspection items such as moisture, ash content, and extract, this paper also established content determination and thin-layer identification using chlorogenic acid and 3, 5-O-dicaffeoylquinic acid as the main components. In terms of indicator component selection, through systematic chemical component separation and identification, it was found that *N. jatamansi* Herba. is rich in phenylpropanoid compounds such as chlorogenic acid and 3, 5-O-dicaffeoylquinic acid. Although this type of ingredient is widely distributed in plants, it has various pharmacological activities such as antibacterial[26-27], anti-inflammatory[28-29], antiviral[30-32], antidepressant[33], antioxidant[34], hepatoprotective and choleretic[35-36], neuroprotective[37], and maintaining blood glucose concentration[38], which are strongly related to the efficacy of *N. jatamansi* Herba. Therefore, this paper chose chlorogenic acid and 3,5-O-dicaffeoylquinic acid as content determination indicators, which had certain theoretical basis and practical significance for the quality control of aboveground medicinal materials of *N. jatamansi* DC. In addition, the contents of nardosinone and volatile oil in *N. jatamansi* Herba. were also determined in this paper. But due to their low content, they were not included in the standard text of quality control of *N. jatamansi* Herba. for control. The content of this standard has been included in the 2020 edition of the *Sichuan Provincial Standard for Tibetan Medicinal Materials*.

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(From page 3)

5 Conclusions

At present, Aconiti Lateralis Radix Praeparata products are mostly used in clinic, mainly Heishun pieces and Baifu pieces. The aconine type of toxic components in decoction pieces of Aconiti Lateralis Radix Praeparata are greatly reduced, and it is difficult to detect them in actual measurement. Moreover, the effective toxic components after processing are also transformed into the benzoylaconitine type, which greatly reduces the toxicity. Therefore, this study mainly determined changes in the content of the benzoylaconitine type. According to the results, compared with the single decoction of Aconiti Lateralis Radix Praeparata (Heishun pieces), the contents of benzoylmesaconine and benzoylaconitine significantly increased in the combined decoction with Trichosanthis Fructus at corresponding decoction time, while the content of benzoylhypacoitine decreased. However, when comparing the total amount, the content of the benzoylaconitine type in the combined decoction was still improved significantly. This result proves to a certain extent the characteristic that "Pinelliae Rhizoma, Trichosanthis Fructus, Fritillariae Cirrhosae Bulbus, Ampelopsis Radix, and Rhizoma Bletillae have severe side effects when used together with *Aconitum* materials" in the "18 incompatible medicaments"[8-13].

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