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Development of dandelion (*Taraxacum* spp.) quality evaluation technology based on phenolic acids

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ABSTRACT

One of the main purposes for which dandelions are cultivated is to derive phenolic acids from their processing. Phenolic acids, which are one of the main useful compounds in dandelion, constitute one of the important groups of therapeutically significant bioactive compounds in traditional Chinese medicine. To carry out a relatively full evaluation of dandelion quality, it was found advisable to use multiple indices to avoid conflict with the single evaluation index stipulated by China Pharmacopoeia. Thus, a quality evaluation method was created based on traditional Chinese medicinal theory and relevant statistics on phenolic acids. Firstly, four main kinds of phenolic acids – caftaric acid, chlorogenic acid, caffeic acid and cichoric acid – were chosen as the main indices for quality evaluation through the optimisation of high performance liquid chromatography detection conditions and fingerprint comparison analysis; then, the content of each component was divided into five levels based on the descriptive statistics of 578 dandelion samples and references; finally, the equal weight average method was used to convert content levels of the four components into a comprehensive quality index, which served as the means for dandelion quality to be identified and segregated into grades, as follows: Grade 1 (super high, probability of 0.8%), Grade 2 (high, 18.72%), Grade 3 (medium, 37.28%), Grade 4 (qualified, 32%) and Grade 5 (low, 11.2%). This method is the first to comprehensively evaluate dandelion quality for setting an industry standard in China, and has practical and scientific characteristics.

Keywords: functional compounds, gradation, quality assessment, *Taraxacum*

INTRODUCTION

Dandelion (*Taraxacum* spp.) is a phytoalimurgic plant having a worldwide distribution, and it has antioxidant, anti-bacterial and anti-inflammatory effects (Grauso et al., 2019). Dandelion is a popular medicinal and edible plant in China. It has been used for tea, feed additives and pharmaceutical raw materials (González-Castejón et al., 2012). However, with the rising demand and price, producers overwhelmingly focussed on the yield; and the result was, particularly given the absence of related evaluation standards, a poor controllability over quality (Chen et al., 2021; Li et al., 2021).

At present, dandelion quality evaluation in China is reliant exclusively on China Pharmacopoeia. China Pharmacopoeia (Ed. 2015) stipulated that caffeic acid content in dandelion should be at least 0.02%; the newly released version stipulated that cichoric acid content shall be >0.45%. However, most researchers pointed out that very complicated effective compounds have been found in dandelion, including phenolic acids, flavonoids and terpenes, *etc.*, and that accordingly, using the concentration of a single chemical component as a quality evaluation standard would be inadequate to fully reflect dandelion quality (Chen et al., 2021; Li et al., 2021).

According to the theory of traditional Chinese medicine, dandelion functions mainly include heat-

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clearing and detoxifying effects, and these are attributed to the rich phenolic acids in dandelion, such as caffeic acid, cichoric acid and chlorogenic acid (González-Castejón et al., 2012). These phenolic acids possess similar chemical molecular structure and chemical properties (Grauso et al., 2019; Tajner-Czopek et al., 2020). Therefore, we may infer that the most reasonable way to evaluate the quality of dandelion intended for therapeutic usage would be to determine the concentration of a few main phenolic acid compounds as key indices.

The usage of multiple indices or statistical methods to evaluate plant traits finds broad application in the literature. Li et al. (2021) evaluated dandelion (*Taraxacum mongolicum* Hand.-Mazz.) quality with methods of hierarchical cluster analysis, principal component analysis and chromatographic fingerprint analysis though the comparison of multiple components in dandelion. Wu et al. (2020b) evaluated the salt-tolerant ability of sunset mallow (*Abelmoschus manihot* (L.) Medik) with linear regression method through the analysis of multiple biochemical indices. Chen et al. (2012) evaluated the drought tolerance of wheat (*Triticum aestivum* L.) using a membership function value method through the analysis of 14 biological indices. These methods produced a comprehensive evaluation value by calculating the weight of each index through complex statistics, resultantly avoiding conflict with the single evaluation index. However, these methods required cumbersome weight calculation, which people not having the requisite specialised skills would find unable to master; additionally, the complex nature of the calculation tasks involved in these methods limited their actual application. Therefore, we developed a comprehensive quality evaluation method for dandelion based on multiple phenolic acid compounds considering the aspects of actual popularisation and application, so as to supplement the deficiency of the single index used in the current China Pharmacopoeia.

MATERIALS AND METHODS

Dandelion samples

Since from 2017, we have collected 96 dandelion resources from different regions of China and together these have been transplanted to the demonstration base of the Institute of Coastal Agriculture, Hebei Academy of Agriculture and Forestry Sciences (North China, 39.23°N, 118.57°E). These resources were cultured in different sites involving greenhouse, saline-alkali land and common field, and harvested in different seasons (spring and autumn). Finally, we obtained a total of 578 dandelion samples. The aboveground parts were harvested after cultivation for 1 month. For related field management, the standard, “Technical specification for cultivation of dandelion in saline-alkali soil” was referred to DB13/T 2986-2019. Dandelion samples were washed and dried at 60 °C. Dry samples were ground and passed by 100-mesh sieve. Water content in the resulting fine powders was controlled <13% according to the stipulation of China Pharmacopoeia. Parts of dandelion samples with some indices were assigned to testing companies, and related details of dandelion samples and examination results are shown in Table S1 in Supplementary Materials.

Phenolic compounds extraction

Phenolic acids were extracted based on our previously published method (Wu et al., 2020a). About 0.5 g dry powder was mixed with 15 mL cellulase solution (cellulase dosage, 0.1%; enzyme activity, 3,000 U · g^{-1}) and placed in water bath at 60 °C for 30 min. Then, 15 mL of methanol was added, and ultrasonic treatment was continued for 30 min (ultrasonic power 400 W). The extract was cooled to room temperature, filtered with a 0.45 μm membrane and then examined using high performance liquid chromatography (HPLC).

Phenolic compounds’ examination

The extract was checked by HPLC (HPLC 1200 series, Agilent Technologies Inc., USA) equipped with chromatographic column (Mars ODS-AQ (4.6 mm × 250 mm, 5 μm), Hming Technologies Co. Ltd, China) under our optimised HPLC conditions based on the technical specifications laid down under China Pharmacopoeia (Eds 2015 and 2020). The optimal determination conditions based on our equipment were the following: injection volume, 0.5 μL; flow rate, 1 mL · min^{-1}; methanol:0.2% phosphoric acid ratio, 40:60; detection wavelength, 327 nm; and detection time, 15 min. Meanwhile, the contents of four kinds of phenolic acids were determined by the following linear regression equations (Table 1) based on quantitative analysis with standard chemicals of caftaric acid, chlorogenic acid, caffeic acid and cichoric acid (Li et al., 2021).

Data analysis

Determination of main evaluation indices

Fifteen random HPLC detection spectrums from 578 dandelion samples were imported into the software of Similarity Evaluation System for Chromatographic Fingerprint of TCM published by Chinese Pharmacopoeia Commission (version 2012, Beijing, China) using median method and an adjustment retention time (RT) of 0.1 min. According to the combination analysis of similarity assessment and matching numbers for each component shown in HPLC spectrum, the common and dominant phenolic compounds were chosen as the main index for quality evaluation (Wu et al., 2020).

Compound content classification

Data pertaining to the weights of the main compounds contained in the dandelion samples, together with data from quality evaluation related references, were analysed by SPSS 19.0 software (IBM SPSS Statistics,

Table 1. Linear regression equations for four compounds in dandelion.

Compounds	Equations	R^2	Valid scope (µg · mL^{-1})
Caftaric acid	Y = 0.6342x + 1.0263	0.9965	10–70
Chlorogenic acid	Y = 0.4946x – 0.8089	0.9669	5–30
	Y = 0.6148x + 0.9279	0.9997	30–105
Caffeic acid	Y = 0.4605x – 0.8895	0.9905	5–30
	Y = 0.39x + 0.814	0.9994	30–105
Cichoric acid	Y = 0.4564x + 3.0071	0.9995	45–220
	Y = 0.569x – 60.97	0.9502	240–512

Y represents the component content (µg · mL^{-1}), and x the HPLC peak area.
HPLC, high performance liquid chromatography.

USA) using descriptive statistics involving mean, mode, median and frequency. Then, based on statistics and general level division methods with a certain percentage used in the literature cited in the present article or in the industrial standards in force in China, each compound content was divided into five levels from low to high, of which Level 1 represented the highest content.

Dandelion quality evaluation

Using the equal weight average calculation method, the content level of each component was converted into a quality index (QI) according to the following formula:

$$QI = \Sigma G_i/(n \times 5) \times 100$$

where G_i represents the content level of each component and n the number of components; here n was 4 and the level numbers were 5.

According to the QI formula, totally 17 QIs were obtained and then the probability or proportion of each QI was calculated based on the completely random combination of all levels for four components. Considering that setting industry standards in China is possible only by satisfying the requirements of high standard and universality, here we stipulated that the probability of QI <1% be classified into Grade 1, indicating the super high content, while most samples were classified into Grades 2–5, and the overall hierarchical structure was spindle-shaped.

RESULTS AND DISCUSSION

Selection of evaluation indices based on HPLC determination result

We tested HPLC conditions following the method from China Pharmacopoeia and found that some peaks, except for caffeic acid or cichoric acid, were obviously shown in the HPLC spectrum, but the separation of these peaks was unclear (Figure 1A). Thus, we adjusted HPLC conditions and obtained an ideal HPLC spectrum (Figure 1B). Through HPLC fingerprint comparison analysis, totally 17 compounds were found, of which four compounds (corresponding retention times, ~4.2 min, ~4.7 min, ~6.1 min and ~10.0 min, respectively) showed 100% matching numbers with the reference fingerprint, and they were identified as caftaric acid, chlorogenic acid, caffeic acid and cichoric acid by standard chemicals (Figure 1C and Table S2 in Supplementary Materials). The four compounds possessed similar molecular structures and belonged to phenolic acids (González-Castejón et al., 2012; Tajner-Czopek et al., 2020). Thus, the four compounds were preliminarily considered as candidates for main quality evaluation indices.

Dandelion is theorised to contain complex components and the presence of all of these components has not been proved as yet, and neither have the therapeutic effectiveness or other useful functions of a majority of these components been demonstrated as yet (Fatima et al., 2018). We referred to the traditional Chinese medicine theory that attributes heat-clearing and detoxifying effects to dandelion, and additionally considered the inference that these effects derive mainly from the phenolic acids that are present in this plant. Therefore, we selected some main phenolic acids as the key evaluation indices that could reflect dandelion quality with some extent (Fatima et al., 2018; Lis and Olas, 2019). However, choosing too many or few indices was deemed unsuitable owing to redundancy or insufficiency, respectively. From Figure 1, we see that some unknown compounds (e.g. retention time at ~5.5 min, ~7.1 min and ~10.8 min) were also found in parts of the dandelion samples; however, the four phenolic acids were found in all of the 15 dandelion samples and belonged to caffeic acid derivatives (Tajner-Czopek et al., 2020).

The content (by weight) of each compound in dandelion was different, and the effectiveness of each of these compounds with regard to a particular function (e.g., with regard to a therapeutic function, studies have identified chlorogenic acid as exerting a significant hypoglycaemic action) was also different. Compounds such as caffeic acid, chlorogenic acid and chicoric acid were the most abundant phenolic compounds in dandelion, and these have been recognised to exhibit significant antioxidant, anti-inflammatory, anti-bacterial and anti-carcinogenic effects (Didier et al., 2011). Dandelion has also been reported to contain significant amounts of phytosterols and derivatives such as plant sterols, stanols and sitosterol (Ovesnaâ et al., 2004),

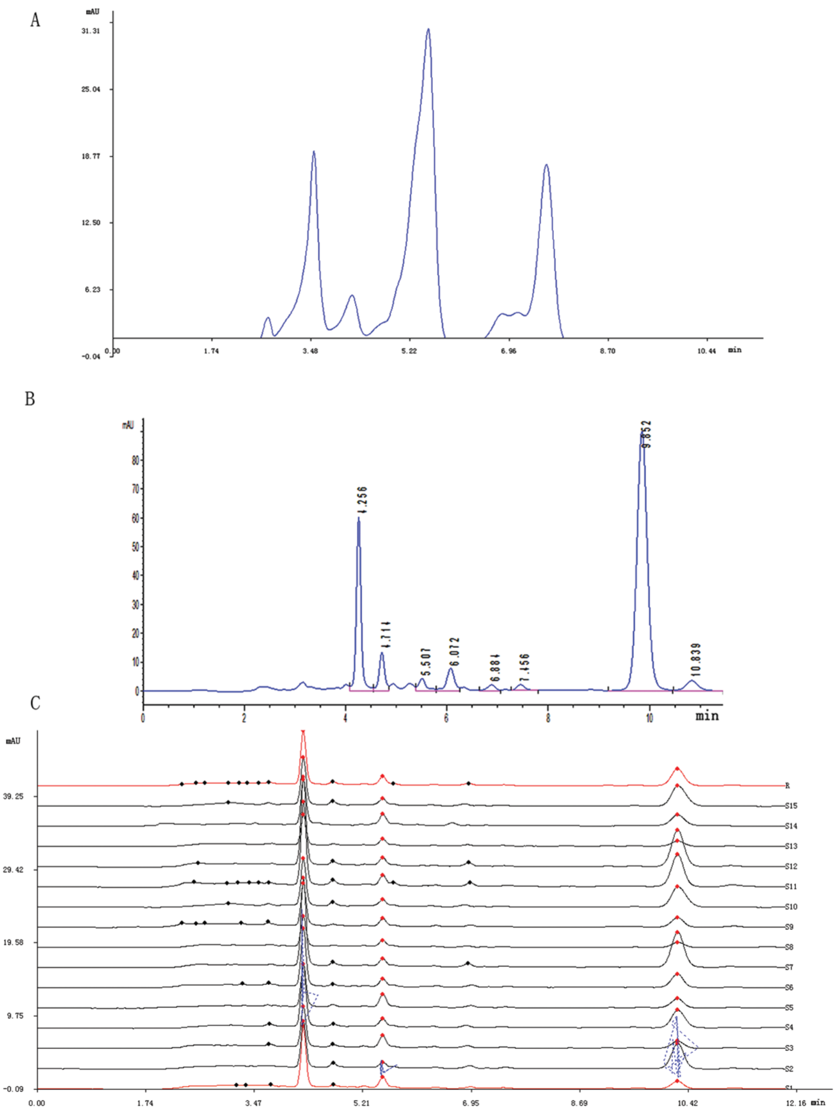

Figure 1. Optimisation of HPLC determination conditions and fingerprint analysis. (A) HPLC spectrum using determination conditions from China Pharmacopoeia; (B) optimised HPLC conditions; (C) fingerprint analysis, of which S1–S15 represents randomly selected dandelion HPLC spectrums, R indicates the reference fingerprint generated by the comparison of 15 samples and the dot on the fingerprint map represents a compound found in dandelion. HPLC, high performance liquid chromatography.

and also to exhibit anti-inflammatory activity, anti-inflammatory effect and anti-cancer properties (Aldini et al., 2014). However, the effectiveness of each component in dandelion is difficult to compare. In order to better evaluate the overall quality, some researchers used membership function, principal component analysis and fingerprint similarity analysis to determine the weight of each compound in dandelion. However, the actual operation of these methods is complex and inconvenient, especially for the purposes of popularisation and application for people lacking a specialised knowledge in these statistical techniques. Hence, the current method of dandelion quality evaluation in China mainly follows China Pharmacopoeia, although the single evaluation index used in the Pharmacopoeia has been subject to some dispute. To ensure a comprehensive approach, we adopted the equal weight average calculation method, and referring to local standards presently applicable in China, converted the above four phenolic acids into a QI to evaluate the quality of dandelion, as follows.

Statistical analysis result

Descriptive statistics

We conducted statistical analyses on dandelion samples and collected data from some references meanwhile (shown in Table 2 and 3; and Table S1 in Supplementary Materials). The statistical data in Table 2 and 3 are the reference sources used to classify the content level of each component.

Correlation analysis

The four compound contents showed different extents of positive correlation according to Pearson correlation coefficient analysis (Table 4). China Pharmacopoeia (Ed. 2020) stipulated the content of cichoric acid as the one and only quality evaluation index. However, further linear regression analysis showed that the coefficient of determination (R^2) of cichoric acid and those of the other three components were perceptibly different (Figure 2). Especially, the R^2 of cichoric acid and caffeic acid was 0.1978, implying that using the content of cichoric acid to represent other components to evaluate dandelion quality was still insufficient. Therefore, the detection of the content of only one component could not suffice for the comprehensive evaluation of the quality of dandelion.

Division of content level in dandelion

Cichoric acid content level

China Pharmacopoeia (Ed. 2020) stipulated that the content of cichoric acid in dandelion shall exceed 0.45%, and that in dandelion herbal pieces it shall not be <0.3%. The cichoric acid content in Table 2 ranges from 0.0175% to 2.1732%, with an average of 0.3834%. Based on referring the division method used in Hao's dissertation (2010), content <80% of the average was defined as low (literature 1; Table 3), and thus that value was just in line

Table 2. Descriptive statistics of four components (%) in dandelion.

Compounds	Numbers	Min–Max	Mean	Mode	Median
Cichoric acid	470	0.0175–2.1732	0.3834	0.0714	0.0369
Caffeic acid	437	0.0010–0.0600	0.0155	0.0138	0.0025
Chlorogenic acid	437	0.0011–0.5337	0.0828	0.0294	0.0023
Caftaric acid	465	0.0234–0.6419	0.1705	0.0858	0.0576

Table 3. Data of components contents (%) from relevant references.

Literature sources	Numbers	Statistics	Cichoric acid	Caffeic acid	Chlorogenic acid	Caftaric acid
Literature 1 (Hao, 2010)	25	Min	–	0.008	0.0050	–
		Max		0.0455	0.0470	
		Mean		0.0189	0.0173	
Literature 2 (Lang et al., 1999)	29	Min	–	0.0089	0.0363	–
		Max		0.0559	3.7819	
		Mean		0.0248	0.5154	
Literature 3 (Liu et al., 2017)	11	Min	0.104	0.013	0.015	0.103
		Max	0.599	0.051	0.072	0.441
		Mean	0.272	0.033	0.035	0.307
Literature 4 (Chen et al., 2018)	15	Min	0.266	0.022	0.030	0.180
		Max	0.909	0.060	0.072	0.359
		Mean	0.608	0.036	0.046	0.286
Literature 5 (Ning et al., 2012)	11	Min	–	0.0281	0.0338	–
		Max		0.0184	0.0802	
		Mean		0.0281	0.0576	

– indicates not checked.

Table 4. Pearson correlation analysis for four components in dandelion.

Components	Cichoric acid	Caffeic acid	Chlorogenic acid	Caftaric acid
Cichoric acid	1	0.410	0.934	0.889
Caffeic acid		1	0.451	0.674
Chlorogenic acid			1	0.774
Caftaric acid				1

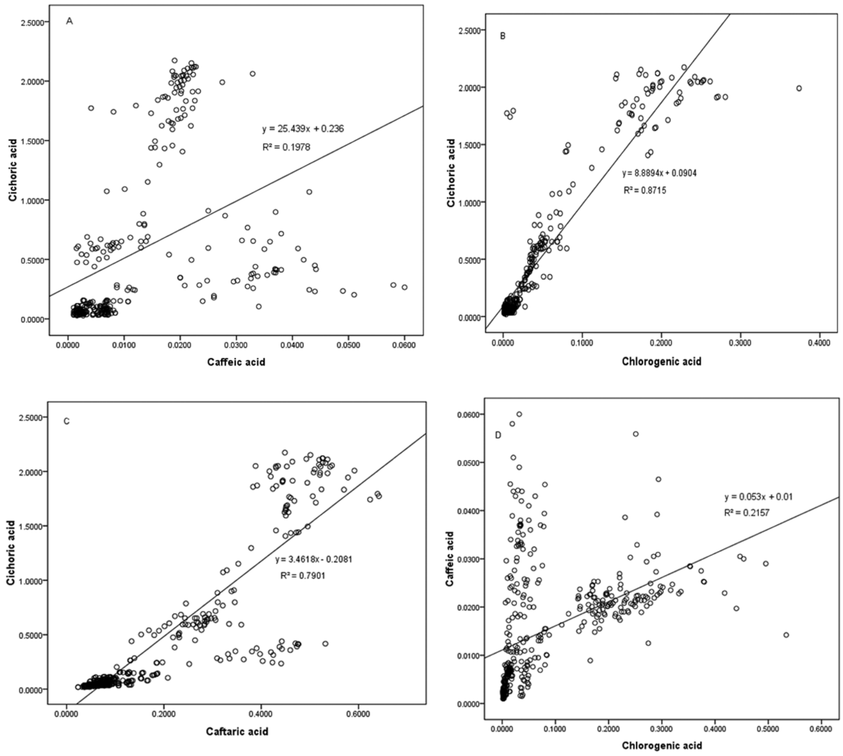

Figure 2. Linear regressions of four compounds' contents (%) in dandelion.

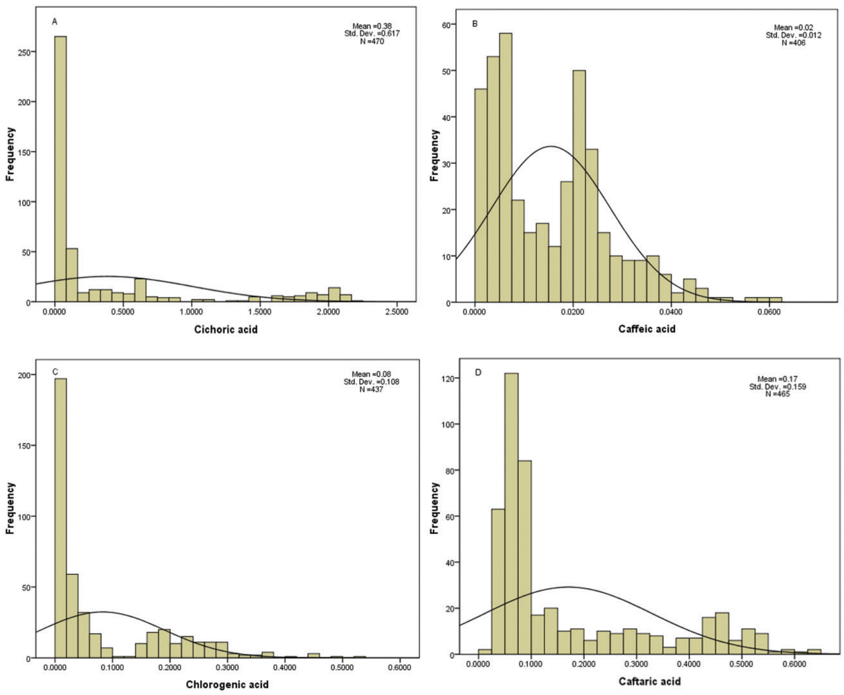

Figure 3. Distributions of four compounds contents (%) that cichoric acid (A), caffeic acid (B), chlorogenic acid (C) and caftaric acid (D).

with the provisions of Pharmacopoeia. Therefore, the content <0.3% was defined as low (Level 5).

Figure 3A showed that the contents of most samples were distributed within 1.2%, which was almost consistent with studies from the literature cited in Table 3. Thus, the valid division range was considered from 0% to 1.2%, and the division of other content levels was comprehensively determined as follows: the reasonable division was reckoned at 0.3%–0.5% as Level 4 referenced from China Pharmacopoeia, 0.5%–0.65% as Level 3 referenced from Chen et al. (2018) (literature 4; Table 3), 0.65%–0.75% as Level 2 and >0.75% as Level 1 referenced from histograms (Figure 3A).

Caffeic acid content level

China Pharmacopoeia (Ed. 2015) stipulated that the content of caffeic acid in dandelion shall be >0.02%. The caffeic acid content in Table 2 ranges from 0.001% to 0.06%, with an average of 0.0155%. Similarly, content <80% of the average, and for convenience of application, here <0.015%, was defined as low (Level 5). Histograms of caffeic acid contents showed a relatively uniform distribution (Figure 3B), and thus the percentage distance of 0.01 was reasonable for the division of the rest of content levels as follows: 0.015%–0.025% was determined as Level 4, 0.025%–0.035% as Level 3, 0.035%–0.045% as Level 2 and >0.045% as Level 1.

Chlorogenic acid content level

China Pharmacopoeia did not indicate chlorogenic acid content as QI, and therefore we had to divide its content level based on statistical analysis and related references. The chlorogenic acid content in Table 2 ranges from 0.001% to 0.5337%, with an average of 0.0828%, mode of 0.0294% and median of 0.0023%. The overall contents' distribution was relatively uniform, except for the two obvious parts divided at 0.1% (Figure 3C). Ling et al. (1999) (literature 2; Table 3) showed the highest content with an average of 0.5154%, which may be the outcome of either actually high content in dandelion or errors of determination results. However, data from the remaining studies cited in this paper were consistent with the statistical analysis. In summary, referring to the mode in Table 2, <0.03% was defined as low (Level 5); <0.085% according to the mean was Level 4; <0.15% (around twice of mean) was Level 3; <0.25% was Level 2 and >0.25% was Level 1 based on histograms (Figure 3C).

Caftaric acid content level

Similarly, Caftaric acid was not mentioned in China Pharmacopoeia for dandelion. The caftaric acid content in Table 2 ranged from 0.0234% to 0.6419%, with an average of 0.1705%, mode of 0.0858% and median of 0.0576%. The overall contents' distribution was relatively uniform (Figure 3D). The data distribution evident in the studies cited in Table 3 was similar to that discerned from the statistical analysis. Thus, <0.1% was defined as low (Level 5) according to the mean and mode; and then the remaining content levels were divided sequentially based on the interval distance of 0.1, as follows: 0.1%–0.2% was reckoned as Level 4, 0.2%–0.3% as Level 3, 0.3%–0.4% as Level 2 and >0.4% as Level 1. Finally, we summarise the four kinds of phenolic acids' content levels in Table 5.

Dandelion quality evaluation

The equal weight average calculation method was used here. Actually, this method is often adopted in domestic or industrial standard setting in China, and some examples are "Rules for characterisation and evaluation of cotton salt tolerance" (DB13/T 1339-2010), "Technical code of practice for identification of salt tolerance in rice" (NY/T 3692-2020) and "Evaluation guidance for water security" (DB37/T 4499-2022). In the present study, the content levels of four components were converted into a dandelion QI. From Table 5 and using the QI formula, totally 625 complete combinations and 17 QIs were obtained. According to the design requirements of quality standards, the probability within 1% was classified into Grade 1, and the rest were divided according to spindle structure. The above results are shown in Table 6.

Quality evaluation result for dandelion samples

A total of 578 dandelion samples were checked, of which the quality levels of 324 samples with four phenolic acids were evaluated, as shown in Table 7 and Table S1 in Supplementary Materials. Of that quantity, Grade 1 samples amounted to 0.62%, and Grade 5 to 58.95%, indicating that the overall quality of this batch of dandelion samples was low, and that the overall samples collected from the greenhouse presented a lower compounds' content compared with samples cultured in saline land (Table S1 in Supplementary Materials).

According to the 2020 report from National Institutes for Food and Drug Control (Zhang et al., 2021), the overall dandelion quality in Hebei Province, China was generally substandard, going by the method of assessment recommended by China Pharmacopoeia (Ed. 2015). It has been suggested that the low concentration of phenolic acid compounds in dandelion plants cultivated in this province is attributable to the cultivation method employed, since

Table 5. Contents (%) level division for dandelion.

Index/level	1	2	3	4	5
Cichoric acid	≥0.750	≥0.650	≥0.500	≥0.300	<0.300
Caffeic acid	≥0.045	≥0.035	≥0.025	≥0.015	<0.015
Chlorogenic acid	≥0.250	≥0.150	≥0.085	≥0.030	<0.030
Caftaric acid	≥0.400	≥0.300	≥0.200	≥0.100	<0.100

Table 6. Dandelion QI and grade division.

QI	Grade	Numbers	Total	Result	Probability (%)
20	1	1	5	Super high	0.8
25	1	4			
30	2	10	117	High	18.72
35	2	20			
40	2	35			
45	2	52			
50	3	68	233	Medium	37.28
55	3	80			
60	3	85			
65	4	80	200	Qualified	32
70	4	68			
75	4	52			
80	5	35	70	Low	11.2
85	5	20			
90	5	10			
95	5	4			
100	5	1			

QI, quality index.

Table 7. Quality evaluation result for 578 dandelion samples.

Grade	Super high (Grade 1)	High (Grade 2)	Medium (Grade 3)	Qualified (Grade 4)	Low (Grade 5)
Quantity	2	54	32	45	191
Percentage (%)	0.62	16.67	9.88	13.89	58.95

producers focussed on maximising dandelion yield and accordingly input a large amount of fertiliser and water, leading to the dandelions' rapid growth, and thus insufficient accumulation of the needed components (Wu et al., 2019; Zhang et al., 2021). Considering this situation, the dandelion evaluation standard could be appropriately decreased; however, improving dandelion quality with regard to the aspects of cultivation technology or breeding technology has remained the fundamental strategy. In addition, we proposed an idea for dandelion quality evaluation; however, the determination of evaluation indices may be adjusted following the deepening understanding of functional components of dandelion in future.

CONCLUSIONS

A dandelion quality evaluation method that is relatively comprehensive and capable of widespread application was developed based on phenolic acids' analysis from 578 samples and related references. Four phenolic acids, namely cichoric acid, caffeic acid, chlorogenic acid and caftaric acid, were chosen as the main evaluation indices. Contents of the four phenolic acids were divided into five levels and then converted into a dandelion QI using the equal weight average calculation method. Finally, five grades of dandelion quality were identified according to the QI, namely Grade 1 (super high, 0.8%), Grade 2 (high, 18.72%), Grade 3 (medium, 37.28%), Grade 4 (qualified, 32%) and Grade 5 (low, 11.2%). Advantageously, this method enabled avoiding conflict with that of the single evaluation index used in China Pharmacopoeia, possesses the characteristics of scientific nature and widespread applicability or reproducibility and can be more conveniently adopted by dandelion industries or research facilities even in the absence of specialised knowledge of statistical techniques.

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AUTHOR CONTRIBUTIONS

Z.W. and X.W. – conceptualisation, methodology, investigation, writing and review of the manuscript. Z.L. and Y.Y. – review and editing, data analysis. X.L. – investigation, validation. All authors read and approved the final manuscript.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

Aldini, R., Micucci, M., Cevenini, M., Fato, R., Bergamini, C., Nanni, C., Cont, M., Camborata, C., Spinozzi, S., and Montagnani, M. (2014). Antiinflammatory effect of phytosterols in experimental murine colitis model: Prevention, induction, remission study. *PLoS ONE*, *9*(9), e108112, doi: 10.1371/journal.pone.0108112.

Chen, J., Gong, D., Liu, X., Sun, G., and Sun, W. (2021). Quality and antioxidant activity evaluation of dandelion by HPLC with five-wavelength fusion fingerprint. *New Journal of Chemistry, 45*(22), 9856–9863.

Chen, M., Kong, J., Zhang, Y., He, J., Sun, R., Huang, G., Lu, D., Wu, Q., Wang, M., Li, W., Li, S., Fan, Y., Feng, X., Huang, Y., Jiang, Y., and Shi, R. (2018). Quantitative determination of phenolic characteristic components in *Taraxaci herba* and its correlation analysis of quality characterization of specific chromatogram. *Chinese Journal of Experimental Traditional Medical Formulae, 24*(16), 12–20.

Chen, X., Min, D., Yasir, T. A., and Hu, Y. G. (2012). Evaluation of 14 morphological, yield-related and physiological traits as indicators of drought tolerance in Chinese winter bread wheat revealed by analysis of the membership function value of drought tolerance (MFVD). *Field Crops Research, 137,* 195–201.

Didier, F., Catherine, F., Odile, T., and Jean-Louis, L. (2011). Caffeoyl derivatives: Major antioxidant compounds of some wild herbs of the Asteraceae family. *Food and Nutrition Sciences*, 2, 181–192.

Fatima, T., Bashir, O., Naseer, B., and Hussain, S. Z. (2018). Dandelion: Phytochemistry and clinical potential. *Journal of Medicinal Plants Studies, 6,* 198–202.

González-Castejón, M., Visioli, F., and Rodriguez-Casado, A. (2012). Diverse biological activities of dandelion. *Nutrition Reviews, 70*(9), 534–547.

Grauso, L., Emrick, S., De Falco, B., Lanzotti, V., and Bonanomi, G. (2019). Common dandelion: A review of its botanical, phytochemical and pharmacological profiles. *Phytochemistry Reviews, 18*(4), 1115–1132.

Hao, Z. (2010). *Studies on the quality standard of dandelion*. M.Sc. dissertation, Henan University of Chinese Medicine, China, doi: 10.7666/d.d196724.

Li, C., Tian, Y., Zhao, C., Li, S., Wang, T., Qiao, B., and Fu, Y. (2021). Application of fingerprint combined with quantitative analysis and multivariate chemometric methods in quality evaluation of dandelion (*Taraxacum mongolicum*). *Royal Society Open Science, 8*(10), 210614, doi: 10.1098/rsos.210614.

Ling, Y., Fang, G., Xiao, Y., and Zheng, J. (1999). Studies on quality standard of dandelions (*Taraxacum* Weber). *Chinese Traditional and Herbal Drugs*, 12, 897–899.

Lis, B., and Olas, B. (2019). Pro-health activity of dandelion (*Taraxacum officinale* L.) and its food products – history and present. *Journal of Functional Foods*, 59, 40–48.

Liu, Y., Lan, R., Dui, J., and Su, Y. (2017). Simultaneous determination of monocaffeyltartaric acid, chlorogenic acid, caffeic acid and chicoric acid in herba taraxaci by HPLC. *China Pharmacist, 20*(9), 1677–1679.

Ning, W., Jia, Q., Zhu, D., and Tianlai, L. (2012). Determination of chlorogenic acid and caffeic acid in 11 species of *Taraxacum* distributed in northeast China. *Journal of Shenyang Agricultural University, 43*(5), 595–598.

Ovesná, Z., Vachálková, A., and Horváthová, K. (2004). Taraxasterol and b-sitosterol: New naturally compounds with chemoprotective/chemopreventive effects mini review. *Neoplasma, 51*(6), 407–414.

Tajner-Czopek, A., Gertchen, M., Rytel, E., Kita, A., Kucharska, A. Z., and Sokół-Łętowska, A. (2020). Study of antioxidant activity of some medicinal plants having high content of caffeic acid derivatives. *Antioxidants, 9*(5), 412, doi: 10.3390/antiox9050412.

Wu, Z., Li, Z., Xue, Z., Lu, X., and Wang, X. (2020a). Optimization of extraction technology for determination of caffeic and chlorogenic acid in dandelion. *Banat's Journal of Biotechnology, 11*(21), 26–37.

Wu, Z., Xue, Z., Lu, X., Jia, Y., Wang, X., and Zhang, X. (2020b). Salt-tolerance identification and quality evaluation of *Abelmoschus manihot* (L.) Medik. *Canadian Journal of Plant Science, 100*(5), 568–574.

Wu, Z., Xue, Z., Li, H., Zhang, X., Wang, X., and Lu, X. (2019). Cultivation of dandelion (*Taraxacum erythropodium*) on coastal saline land based on the control of salinity and fertilizer. *Folia Horticulturae, 31*(2), 277–284.

Zhang, P., Guo, X.-H., Jing, W.-G., Li, M.-H., Cheng, X.-L., Wei, F., and Ma, S.-C. (2021). Quality of Chinese medicinal materials and decoction pieces in 2020. *Modern Chinese Medicine, 23*(10), 1671–1678.

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SUPPLEMENTARY MATERIALS

Table S1. Compounds' content (%) of 578 dandelion samples.

No.	Caftaric acid	Chlorogenic acid	Caffeic acid	Cichoric acid	Original site	State	QI
1	0.0323	0.0037	0.0012	0.0195	Tanghai 1	G-F	100
2	0.0409	0.0011	0.0011	0.0317	Tanghai 2	G-F	100
3	0.0409	0.0021	0.001	0.0314	Tanghai 3	G-F	100
4	0.0411	0.0013	0.001	0.0345	Tanghai 4	G-F	100
5	0.0414	0.0013	0.001	0.0321	Tanghai 5	G-F	100
6	0.0419	0.0013	0.0011	0.0338	Tanghai 6	G-F	100
7	0.0424	0.0017	0.0016	0.0274	Tanghai 7	G-F	100
8	0.0449	0.0015	0.0011	0.0376	Tanghai 8	G-F	100
9	0.0452	0.0017	0.0012	0.0469	Tanghai 9	G-F	100
10	0.0452	0.0027	0.002	0.0339	Tanghai 10	G-F	100
11	0.0457	0.0017	0.0027	0.0275	Tanghai 11	G-F	100
12	0.0457	0.0019	0.0011	0.0474	Tanghai 12	G-F	100
13	0.0465	0.0021	0.001	0.048	Luannan 1	G-F	100
14	0.047	0.0013	0.001	0.0418	Luannan 2	G-F	100
15	0.047	0.0013	0.0012	0.042	Luannan 3	G-F	100
16	0.047	0.0027	0.0016	0.0338	Luannan 4	G-F	100
17	0.0475	0.0025	0.002	0.0339	Luannan 5	G-F	100
18	0.0477	0.0013	0.0011	0.0699	Kaiping 1	G-F	100
19	0.0482	0.0015	0.0012	0.0704	Kaiping 2	G-F	100
20	0.0485	0.0015	0.0011	0.0706	Kaiping 3	G-F	100
21	0.0488	0.0023	0.0011	0.0296	Yixian 1	G-F	100
22	0.0488	0.0023	0.0012	0.0301	Yixian 2	G-F	100
23	0.0498	0.0011	0.0011	0.0369	Yixian 3	G-F	100
24	0.0546	0.0021	0.0012	0.0465	Yixian 4	G-F	100
25	0.0559	0.0037	0.002	0.0814	Yixian 5	G-F	100
26	0.0559	0.0049	0.0025	0.0443	Yixian 6	G-F	100
27	0.0564	0.0179	0.0051	0.1018	Shexian 1	G-F	100
28	0.0566	0.0023	0.001	0.0617	Shexian 2	G-F	100
29	0.0566	0.0051	0.0027	0.0447	Shexian 3	G-F	100
30	0.0569	0.011	0.0065	0.0369	Shexian 4	G-F	100
31	0.0569	0.0023	0.0014	0.0613	Shexian 5	G-F	100
32	0.0574	0.0033	0.0022	0.0821	Shexian 6	G-F	100
33	0.0574	0.0039	0.0011	0.0619	Handan 1	G-F	100
34	0.0576	0.0055	0.0044	0.0316	Handan 2	G-F	100
35	0.0576	0.0055	0.0054	0.0356	Handan 3	G-F	100
36	0.0576	0.0035	0.0011	0.0787	Handan 4	G-F	100
37	0.0581	0.0051	0.0025	0.0453	Zhangjiakou 1	G-F	100
38	0.0589	0.0047	0.0044	0.0403	Zhangjiakou 2	G-F	100
39	0.0592	0.0118	0.0065	0.0369	Zhangjiakou 3	G-F	100
40	0.0594	0.0043	0.0031	0.0575	Zhangjiakou 4	G-F	100
41	0.0594	0.0082	0.0071	0.0356	Zhangjiakou 5	G-F	100
42	0.0594	0.0116	0.0068	0.0356	Zhangjiakou 6	G-F	100
43	0.0597	0.0189	0.0057	0.1092	Hengshui 1	G-F	100
44	0.0597	0.0191	0.0058	0.1099	Hengshui 2	G-F	100
45	0.0599	0.0043	0.0027	0.0568	Hengshui 3	G-F	100

(*Continued*)

Table S1. Continued.

No.	Caftaric acid	Chlorogenic acid	Caffeic acid	Cichoric acid	Original site	State	QI
46	0.0602	0.0043	0.0029	0.0551	Hengshui 4	G-F	100
47	0.0607	0.0015	0.0011	0.0454	Hengshui 5	G-F	100
48	0.0612	0.0092	0.0071	0.0336	Xingtai 1	G-F	100
49	0.0622	0.0063	0.0045	0.0407	Xingtai 2	G-F	100
50	0.0627	0.0011	0.0025	0.0471	Cangzhou 1	G-F	100
51	0.0637	0.0132	0.0071	0.0763	Cangzhou 2	G-F	100
52	0.064	0.0094	0.0056	0.0341	Cangzhou 3	G-F	100
53	0.065	0.0021	0.0014	0.0394	Chongli 1	G-F	100
54	0.065	0.0033	0.0031	0.0562	Chongli 2	G-F	100
55	0.0655	0.0134	0.0068	0.0787	Chongli 3	G-F	100
56	0.0655	0.0061	0.0053	0.048	Baoding 1	G-F	100
57	0.0657	0.0094	0.0066	0.0422	Baoding 2	G-F	100
58	0.0663	0.0071	0.0077	0.0467	Baoding 3	G-F	100
59	0.0665	0.0011	0.0012	0.0347	Baoding 4	G-F	100
60	0.067	0.0078	0.0053	0.0323	Baoding 5	G-F	100
61	0.0675	0.0098	0.006	0.1018	Chengde 1	G-F	100
62	0.0688	0.0037	0.0012	0.0695	Chengde 2	G-F	100
63	0.0688	0.0039	0.0033	0.0595	Chengde 3	G-F	100
64	0.069	0.0146	0.0066	0.084	Zunhua 1	G-F	100
65	0.0693	0.0041	0.0051	0.0487	Zunhua 2	G-F	100
66	0.0698	0.0039	0.0033	0.0589	Zunhua 3	G-F	100
67	0.0703	0.0043	0.0014	0.0717	Renqiu 1	G-F	100
68	0.0708	0.0017	0.001	0.037	Renqiu 2	G-F	100
69	0.0729	0.0047	0.0022	0.0734	Renqiu 3	G-F	100
70	0.0734	0.0021	0.0011	0.0913	Shenyang 1	G-F	100
71	0.0734	0.0104	0.0065	0.0558	Shenyang 2	G-F	100
72	0.0736	0.0013	0.0011	0.0905	Shenyang 3	G-F	100
73	0.0749	0.0023	0.0025	0.0657	Dalian 1	G-F	100
74	0.0749	0.0027	0.0025	0.0657	Dalian 2	G-F	100
75	0.0751	0.0146	0.0025	0.1117	Dalian 3	G-F	100
76	0.0751	0.0128	0.0066	0.056	Shandong 1	G-F	100
77	0.0754	0.0023	0.002	0.0542	Shandong 2	G-F	100
78	0.0754	0.0031	0.0016	0.0684	Shandong 3	G-F	100
79	0.0754	0.0276	0.0072	0.0869	Nemenggu 1	G-F	100
80	0.0764	0.0136	0.0069	0.0832	Nemenggu 2	G-F	100
81	0.0769	0.0124	0.006	0.0454	Nemenggu 3	G-F	100
82	0.0774	0.0015	0.0029	0.0449	Dandon 1	G-F	100
83	0.0774	0.0148	0.0038	0.1148	Dandon 2	G-F	100
84	0.0777	0.0031	0.001	0.0951	Dandon 3	G-F	100
85	0.0777	0.0121	0.0062	0.0712	Zhengzou 1	G-F	100
86	0.0777	0.0132	0.0025	0.115	Zhengzou 2	G-F	100
87	0.0787	0.0084	0.0059	0.0487	Zhengzou 3	G-F	100
88	0.0789	0.0013	0.0027	0.0418	Heilongjiang 1	G-F	100
89	0.0789	0.0169	0.0057	0.0876	Heilongjiang 2	G-F	100
90	0.08	0.0015	0.0018	0.0438	Heilongjiang 3	G-F	100
91	0.08	0.0027	0.0025	0.0571	Xinjiang 1	G-F	100

(Continued)

Table S1. Continued.

No.	Caftaric acid	Chlorogenic acid	Caffeic acid	Cichoric acid	Original site	State	QI
92	0.0807	0.0023	0.0033	0.0369	Xinjiang 2	G-F	100
93	0.0807	0.0114	0.0084	0.0495	Xinjiang 3	G-F	100
94	0.0815	0.0023	0.0033	0.0372	Xian 1	G-F	100
95	0.082	0.0116	0.006	0.073	Xian 2	G-F	100
96	0.082	0.0146	0.0081	0.0719	Xian 3	G-F	100
97	0.0822	0.014	0.0075	0.0721	Tanghai 1	G-F	100
98	0.0825	0.0122	0.0063	0.0734	Tanghai 2	G-F	100
99	0.083	0.0031	0.0025	0.0584	Tanghai 3	G-F	100
100	0.083	0.0118	0.0084	0.0502	Luannan 1	G-F	100
101	0.0838	0.0023	0.0027	0.0381	Luannan 2	G-F	100
102	0.084	0.0015	0.0014	0.0367	Kaiping 1	G-F	100
103	0.084	0.0116	0.0065	0.1059	Kaiping 2	G-F	100
104	0.0843	0.0011	0.002	0.0816	Yixian 1	G-F	100
105	0.0843	0.0144	0.0069	0.0841	Yixian 2	G-F	100
106	0.0845	0.0124	0.0065	0.0814	Shexian 1	G-F	100
107	0.0848	0.0112	0.0065	0.0867	Shexian 2	G-F	100
108	0.0858	0.0078	0.0018	0.0794	Handan 1	G-F	100
109	0.0858	0.01	0.0063	0.0849	Handan 2	G-F	100
110	0.0863	0.0013	0.0025	0.0832	Tanghai 1	G-A	100
111	0.0863	0.0094	0.0054	0.0352	Tanghai 2	G-A	100
112	0.0866	0.009	0.0053	0.0582	Tanghai 3	G-A	100
113	0.0866	0.0124	0.0065	0.1121	Luannan 1	G-A	100
114	0.0871	0.0124	0.0071	0.0595	Luannan 2	G-A	100
115	0.0873	0.0017	0.0016	0.0374	Kaiping 1	G-A	100
116	0.0876	0.0074	0.002	0.0816	Kaiping 2	G-A	100
117	0.0878	0.0122	0.0068	0.0819	Yixian 1	G-A	100
118	0.0881	0.014	0.0072	0.0359	Yixian 2	G-A	100
119	0.0883	0.0134	0.0075	0.1066	Shexian 1	G-A	100
120	0.0886	0.0019	0.002	0.0376	Shexian 2	G-A	100
121	0.0893	0.0063	0.002	0.0874	Handan 1	G-A	100
122	0.0893	0.0138	0.0069	0.0823	Handan 2	G-A	100
123	0.0896	0.0015	0.001	0.0485	Zhangjiakou 1	G-A	100
124	0.0896	0.0027	0.0016	0.1108	Zhangjiakou 2	G-A	100
125	0.0901	0.0027	0.0016	0.1097	Hengshui 1	G-A	100
126	0.0906	0.0029	0.0018	0.1112	Hengshui 2	G-A	100
127	0.0921	0.0011	0.0023	0.0453	Xingtai 1	G-A	100
128	0.0921	0.0013	0.0022	0.0458	Xingtai 2	G-A	100
129	0.0942	0.0118	0.0069	0.0456	Cangzhou 1	G-A	100
130	0.0962	0.0132	0.0063	0.0995	Cangzhou 2	G-A	100
131	0.0967	0.0136	0.0069	0.094	Chongli 1	G-A	100
132	0.0967	0.0043	0.0029	0.1	Chongli 2	G-A	100
133	0.0982	0.0047	0.0034	0.1033	Baoding 1	G-A	100
134	0.0995	0.0152	0.0068	0.0832	Baoding 2	G-A	100
135	0.0997	0.0045	0.0016	0.0903	Chengde 1	G-A	100
136	0.0997	0.0126	0.0069	0.0564	Chengde 2	G-A	100
137	0.101	0.0049	0.0033	0.1055	Zunhua 1	G-A	95

(*Continued*)

Table S1. Continued.

No.	Caftaric acid	Chlorogenic acid	Caffeic acid	Cichoric acid	Original site	State	QI
138	0.103	0.021	0.051	0.203	Zunhua 2	G-A	75
139	0.103	0.0043	0.0016	0.0902	Zunhua 3	G-A	95
140	0.1033	0.0023	0.0012	0.0549	Renqiu 1	G-A	95
141	0.1058	0.0019	0.002	0.0522	Renqiu 2	G-A	95
142	0.1066	0.0015	0.0025	0.0524	Shenyang 1	G-A	95
143	0.1068	0.0011	0.0011	0.0338	Shenyang 2	G-A	95
144	0.1068	0.0013	0.0012	0.0336	Dalian 2	G-A	95
145	0.1071	0.0011	0.0011	0.0336	Shandong 1	G-A	95
146	0.1074	0.0023	0.002	0.0529	Shandong 2	G-A	95
147	0.1086	0.0076	0.0029	0.1546	Nemenggu 1	G-A	95
148	0.1089	0.0086	0.0027	0.1559	Nemenggu 2	G-A	95
149	0.1104	0.0084	0.0027	0.1566	Dandon 1	G-A	95
150	0.1155	0.0063	0.0047	0.0794	Dandon 2	G-A	95
151	0.1162	0.0171	0.0071	0.153	Zhengzou 1	G-A	95
152	0.125	0.015	0.024	0.149	Zhengzou 2	G-A	90
153	0.1259	0.0047	0.0022	0.0715	Heilongjiang 1	G-A	95
154	0.1259	0.0154	0.0066	0.14	Heilongjiang 2	G-A	95
155	0.1271	0.0045	0.0023	0.0719	Xinjiang 1	G-A	95
156	0.1276	0.0179	0.0068	0.142	Xinjiang 2	G-A	95
157	0.1284	0.0164	0.0069	0.1575	Xian 1	G-A	95
158	0.1292	0.0047	0.0023	0.0701	Xian 2	G-A	95
159	0.1297	0.0213	0.0093	0.1517	Tanghai 1	N-F	95
160	0.1304	0.0421	0.0109	0.2638	Tanghai 2	N-F	90
161	0.1315	0.0229	0.0087	0.2645	Tanghai 3	N-F	95
162	0.1327	0.0027	0.0018	0.0774	Luannan 1	N-F	95
163	0.133	0.0021	0.0014	0.0768	Luannan 2	N-F	95
164	0.1334	0.0416	0.0047	0.44	Kaiping 1	N-F	85
165	0.1358	0.0029	0.0016	0.0785	Kaiping 2	N-F	95
166	0.1378	0.0213	0.0107	0.1475	Yixian 1	N-F	95
167	0.1393	0.0361	0.0087	0.2846	Yixian 2	N-F	90
168	0.152	0.0031	0.0057	0.0995	Shexian 1	N-F	95
169	0.1532	0.0369	0.0055	0.5023	Shexian 2	N-F	80
170	0.1533	0.0027	0.0045	0.0969	Handan 1	N-F	95
171	0.1538	0.0027	0.0045	0.098	Handan 2	N-F	95
172	0.1548	0.0162	0.0107	0.1455	Zhangjiakou 1	N-F	95
173	0.155	0.0173	0.0081	0.1502	Zhangjiakou 2	N-F	95
174	0.1573	0.0144	0.0068	0.1517	Hengshui 1	N-F	95
175	0.1649	0.0047	0.0047	0.0792	Hengshui 2	N-F	95
176	0.1672	0.0039	0.0047	0.0796	Xingtai 1	N-F	95
177	0.1691	0.0414	0.018	0.5406	Xingtai 2	N-F	75
178	0.1761	0.0088	0.0036	0.1272	Cangzhou 1	N-F	95
179	0.1779	0.0059	0.0034	0.1285	Cangzhou 2	N-F	95
180	0.18	0.039	0.022	0.496	Chongli 1	N-F	80
181	0.1807	0.0092	0.0038	0.1305	Chongli 2	N-F	95
182	0.1845	0.0059	0.004	0.1389	Baoding 1	N-F	95
183	0.1845	0.0272	0.0106	0.2417	Baoding 2	N-F	95

(*Continued*)

Table S1. Continued.

No.	Caftaric acid	Chlorogenic acid	Caffeic acid	Cichoric acid	Original site	State	QI
184	0.1852	0.0047	0.004	0.1398	Chengde 1	N-F	95
185	0.1857	0.0249	0.0119	0.2422	Chengde 2	N-F	95
186	0.187	0.0051	0.0044	0.1447	Zunhua 1	N-F	95
187	0.1898	0.0344	0.0033	0.5368	Zunhua 2	N-F	80
188	0.1969	0.0286	0.0116	0.2461	Zunhua 3	N-F	95
189	0.2012	0.0577	0.0076	0.5777	Renqiu 1	N-F	75
190	0.208	0.016	0.034	0.104	Renqiu 2	N-F	80
191	0.2109	0.0524	0.009	0.6053	Shenyang 1	N-F	75
192	0.2188	0.0366	0.0032	0.4757	Shenyang 2	N-F	80
193	0.222	0.03	0.033	0.383	Dalian 2	N-F	70
194	0.2225	0.0493	0.0058	0.6703	Shandong 1	N-F	70
195	0.23	0.036	0.042	0.497	Shandong 2	N-F	65
196	0.23	0.0335	0.0011	0.5053	Nemenggu 1	N-F	75
197	0.2314	0.034	0.0016	0.4756	Nemenggu 2	N-F	80
198	0.2316	0.0359	0.0069	0.5158	Dandon 1	N-F	75
199	0.2349	0.0552	0.0111	0.6842	Dandon 2	N-F	70
200	0.2383	0.0803	0.008	0.5941	Zhengzou 1	N-F	75
201	0.2432	0.0615	0.0095	0.6524	Zhengzou 2	N-F	70
202	0.244	0.045	0.025	0.596	Heilongjiang 1	N-F	65
203	0.2452	0.0725	0.0136	0.7869	Heilongjiang 2	N-F	65
204	0.2499	0.0397	0.0049	0.5899	Xinjiang 1	N-F	75
205	0.252	0.021	0.044	0.231	Xinjiang 2	N-F	75
206	0.2602	0.0372	0.0015	0.5937	Xian 1	N-F	75
207	0.2636	0.0686	0.0139	0.6526	Xian 2	N-F	70
208	0.264	0.037	0.044	0.449	Tanghai 1	N-A	65
209	0.2663	0.0419	0.0063	0.5641	Tanghai 2	N-A	75
210	0.2673	0.0425	0.0075	0.614	Tanghai 3	N-A	75
211	0.2674	0.0682	0.013	0.6524	Luannan 1	N-A	70
212	0.2705	0.0384	0.0018	0.6103	Luannan 2	N-A	75
213	0.2739	0.0477	0.0043	0.5881	Kaiping 1	N-A	75
214	0.2772	0.0359	0.0024	0.5438	Kaiping 2	N-A	75
215	0.2804	0.0715	0.0142	0.691	Yixian 1	N-A	70
216	0.283	0.039	0.035	0.587	Yixian 2	N-A	60
217	0.2834	0.0476	0.0052	0.5976	Shexian 1	N-A	75
218	0.2837	0.0476	0.0078	0.6254	Shexian 2	N-A	75
219	0.284	0.053	0.031	0.66	Handan 1	N-A	60
220	0.2874	0.0446	0.007	0.6179	Handan 2	N-A	75
221	0.2876	0.0465	0.008	0.6386	Zhangjiakou 1	N-A	75
222	0.2904	0.0473	0.0086	0.6414	Zhangjiakou 2	N-A	75
223	0.2924	0.0479	0.0034	0.6896	Hengshui 1	N-A	70
224	0.297	0.053	0.036	0.65	Hengshui 2	N-A	55
225	0.304	0.034	0.033	0.655	Xingtai 1	N-A	55
226	0.306	0.05	0.038	0.717	Xingtai 2	N-A	50
227	0.3062	0.0497	0.004	0.6348	Cangzhou 1	N-A	70
228	0.3092	0.0236	0.0234	0.2842	Cangzhou 2	N-A	80
229	0.31	0.0448	0.0134	0.8845	Chongli 1	N-A	60

(*Continued*)

Table S1. Continued.

No.	Caftaric acid	Chlorogenic acid	Caffeic acid	Cichoric acid	Original site	State	QI
230	0.3106	0.0395	0.0127	0.7987	Chongli 2	N-A	60
231	0.316	0.032	0.06	0.266	Baoding 1	N-A	60
232	0.321	0.06	0.032	0.768	Baoding 2	N-A	50
233	0.3215	0.0714	0.0069	1.0737	Chengde 1	N-A	60
234	0.3293	0.083	0.0101	1.0919	Chengde 2	N-A	60
235	0.3317	0.0276	0.0248	0.3212	Zunhua 1	N-A	75
236	0.334	0.072	0.013	0.599	Zunhua 2	N-A	70
237	0.3349	0.0225	0.0208	0.2808	Zunhua 3	N-A	80
238	0.339	0.072	0.037	0.899	Renqiu 1	N-A	45
239	0.344	0.067	0.025	0.909	Renqiu 2	N-A	50
240	0.3456	0.0464	0.0136	0.7979	Shenyang 1	N-A	60
241	0.347	0.051	0.02	0.348	Shenyang 2	N-A	70
242	0.3529	0.0882	0.0142	1.1522	Dalian 2	N-A	55
243	0.359	0.05	0.041	0.592	Shandong 1	N-A	55
244	0.364	0.039	0.032	0.273	Shandong 2	N-A	70
245	0.3793	0.1119	0.0163	1.2967	Nemenggu 1	N-A	50
246	0.381	0.059	0.02	0.346	Nemenggu 2	N-A	70
247	0.3831	0.2189	0.0178	1.8585	Dandon 1	N-A	45
248	0.3884	0.2614	0.0189	2.0501	Dandon 2	N-A	40
249	0.3906	0.0308	0.0327	0.3756	Zhengzou 1	N-A	65
250	0.3915	0.2214	0.0173	1.8708	Zhengzou 2	N-A	45
251	0.3975	0.0277	0.0302	0.3223	Heilongjiang 1	N-A	70
252	0.403	0.037	0.033	0.258	Heilongjiang 2	N-A	65
253	0.4168	0.1977	0.0201	2.0018	Xinjiang 1	N-A	40
254	0.4196	0.2228	0.0199	1.9534	Xinjiang 2	N-A	40
255	0.42	0.027	0.0326	0.3397	Xian 1	N-A	65
256	0.423	0.025	0.043	0.245	Xian 2	N-A	65
257	0.4239	0.1498	0.016	1.8405	Xian 1	S-A	45
258	0.4247	0.027	0.0295	0.3135	Xian 2	S-A	65
259	0.43	0.2457	0.0205	2.0467	Xinjiang 1	S-A	40
260	0.4303	0.1247	0.0186	1.4579	Xinjiang 2	S-A	45
261	0.4303	0.2373	0.0189	2.0335	Heilongjiang 1	S-A	40
262	0.4308	0.154	0.0169	1.8664	Heilongjiang 2	S-A	40
263	0.4343	0.2002	0.0205	2.0508	Zhengzou 1	S-A	40
264	0.4376	0.0324	0.037	0.3885	Zhengzou 2	S-A	55
265	0.441	0.032	0.049	0.235	Dandon 1	S-A	55
266	0.4422	0.035	0.0334	0.4394	Dandon 2	S-A	60
267	0.4425	0.0299	0.0355	0.3689	Nemenggu 1	S-A	60
268	0.4435	0.2696	0.0222	1.9106	Nemenggu 2	S-A	35
269	0.4437	0.2243	0.019	1.9031	Shandong 1	S-A	40
270	0.4445	0.2715	0.0202	1.9174	Shandong 2	S-A	35
271	0.448	0.1441	0.0219	1.6236	Dalian 2	S-A	45
272	0.4486	0.2285	0.019	2.1732	Shenyang 1	S-A	40
273	0.4496	0.1914	0.0187	1.6429	Shenyang 2	S-A	40
274	0.4498	0.1827	0.0204	1.4069	Renqiu 1	S-A	40
275	0.4506	0.1702	0.0186	1.5942	Renqiu 2	S-A	40

(*Continued*)

Table S1. Continued.

No.	Caftaric acid	Chlorogenic acid	Caffeic acid	Cichoric acid	Original site	State	QI
276	0.4506	0.1781	0.0179	1.6643	Zunhua 1	S-A	40
277	0.4513	0.1459	0.0196	1.6809	Zunhua 2	S-A	45
278	0.4513	0.1928	0.0184	1.6488	Zunhua 3	S-A	40
279	0.4526	0.2361	0.0192	2.046	Chengde 1	S-A	40
280	0.4536	0.1466	0.0201	1.6891	Chengde 2	S-A	45
281	0.4559	0.1744	0.0167	1.6247	Baoding 1	S-A	40
282	0.4574	0.1621	0.0205	1.7663	Baoding 2	S-A	40
283	0.4597	0.0293	0.0338	0.3585	Chongli 1	S-A	65
284	0.4605	0.1628	0.0193	1.757	Chongli 2	S-A	40
285	0.4607	0.1864	0.0172	1.4338	Cangzhou 1	S-A	40
286	0.464	0.242	0.0207	2.0899	Cangzhou 2	S-A	40
287	0.4645	0.2806	0.0232	1.9145	Xingtai 1	S-A	35
288	0.4681	0.1739	0.0148	1.7294	Xingtai 2	S-A	45
289	0.4704	0.0346	0.0369	0.4201	Hengshui 1	S-A	55
290	0.4721	0.0787	0.0148	1.4385	Hengshui 2	S-A	55
291	0.4734	0.0333	0.0367	0.3911	Zhangjiakou 1	S-A	55
292	0.475	0.0346	0.037	0.4142	Zhangjiakou 2	S-A	55
293	0.476	0.0343	0.0372	0.4124	Handan 1	S-A	55
294	0.4764	0.0343	0.038	0.4128	Handan 2	S-A	55
295	0.4765	0.0801	0.0155	1.442	Shexian 1	S-A	50
296	0.4927	0.1717	0.022	2.115	Shexian 2	S-A	40
297	0.4947	0.1687	0.0201	1.8958	Yixian 1	S-A	40
298	0.4955	0.082	0.0155	1.4945	Yixian 2	S-A	50
299	0.5011	0.1739	0.022	2.1518	Kaiping 1	S-A	40
300	0.5059	0.1596	0.0222	1.7722	Kaiping 2	S-A	40
301	0.5077	0.3738	0.0275	1.9905	Luannan 1	S-A	25
302	0.5099	0.1891	0.0214	2.0187	Luannan 2	S-A	40
303	0.5122	0.2081	0.0208	1.7135	Tanghai 1	S-A	40
304	0.5188	0.2533	0.0329	2.0622	Tanghai 2	S-A	25
305	0.5191	0.18	0.0213	2.1065	Tanghai 3	S-A	40
306	0.5206	0.1877	0.0204	1.9682	Tanghai 1	S-F	40
307	0.5211	0.1891	0.0195	1.9882	Tanghai 2	S-F	40
308	0.5219	0.1985	0.0202	2.0446	Luannan 1	S-F	40
309	0.5239	0.1643	0.0226	1.8355	Luannan 2	S-F	40
310	0.5257	0.195	0.0225	2.1218	Kaiping 1	S-F	40
311	0.5264	0.213	0.0186	2.0833	Yixian 1	S-F	40
312	0.5267	0.195	0.0228	2.1207	Shexian 2	S-F	40
313	0.5319	0.0295	0.0442	0.4174	Handan 1	S-F	60
314	0.5323	0.1422	0.0217	2.077	Zhangjiakou 3	S-F	45
315	0.5363	0.1434	0.0223	2.1104	Hengshui 2	S-F	45
316	0.5363	0.1808	0.0184	1.9834	Xingtai 1	S-F	40
317	0.5417	0.2504	0.0211	2.043	Cangzhou 2	S-F	35
318	0.5455	0.2523	0.0223	2.0551	Chongli 3	S-F	35
319	0.5701	0.1759	0.021	1.8323	Baoding 3	S-F	40
320	0.5784	0.1827	0.0193	1.9443	Chengde 1	S-F	40
321	0.5916	0.1889	0.0207	2.0078	Shenyang 1	S-F	40

(*Continued*)

Table S1. Continued.

No.	Caftaric acid	Chlorogenic acid	Caffeic acid	Cichoric acid	Original site	State	QI
322	0.6238	0.0087	0.0081	1.7417	Dalian 2	S-F	60
323	0.6391	0.0127	0.0121	1.7941	Shandong 3	S-F	60
324	0.6419	0.0047	0.0041	1.7727	Dandon 1	S-F	60
325		0.01	0.026	0.179	Tanghan 1	N-A	
326		0.017	0.026	0.194	Luannan 1	N-A	
327		0.019	0.058	0.285	Baoding 1	N-A	
328		0.059	0.028	0.868	Zhangjiakou 3	N-A	
329		0.062	0.043	1.068	Tanghai 3	N-A	
330	0.0234			0.0182	Tanghai 1	G-F	
331	0.0236			0.0184	Tanghai 2	G-F	
332	0.0351			0.0328	Tanghai 3	G-F	
333	0.0353			0.0217	Tanghai 4	G-F	
334	0.0353			0.0328	Tanghai 5	G-F	
335	0.0358			0.0255	Tanghai 6	G-F	
336	0.0363			0.0175	Tanghai 7	G-F	
337	0.0366			0.0259	Tanghai 8	G-F	
338	0.0366			0.0348	Tanghai 9	G-F	
339	0.0373			0.0186	Tanghai 10	G-F	
340	0.0373			0.0268	Tanghai 11	G-F	
341	0.0381			0.0212	Tanghai 12	G-F	
342	0.0386			0.031	Luannan 1	G-F	
343	0.0389			0.0325	Luannan 2	G-F	
344	0.0394			0.0288	Luannan 3	G-F	
345	0.0396			0.0243	Luannan 4	G-F	
346	0.0396			0.0312	Luannan 5	G-F	
347	0.0401			0.0277	Kaiping 1	G-F	
348	0.0404			0.0208	Kaiping 2	G-F	
349	0.0406			0.0285	Yixian 1	G-F	
350	0.0406			0.0288	Yixian 2	G-F	
351	0.0411			0.0215	Yixian 3	G-F	
352	0.0414			0.0279	Shexian 1	G-F	
353	0.0414			0.0285	Shexian 3	G-F	
354	0.0439			0.0259	Shexian 4	G-F	
355	0.0452			0.0367	Handan 1	G-F	
356	0.0457			0.0372	Handan 2	G-F	
357	0.0462			0.0378	Handan 3	G-F	
358	0.0467			0.0193	Handan 4	G-F	
359	0.0472			0.0193	Zhangjiakou 1	G-F	
360	0.0475			0.0195	Zhangjiakou 2	G-F	
361	0.0475			0.0338	Zhangjiakou 3	G-F	
362	0.048			0.0219	Zhangjiakou 4	G-F	
363	0.048			0.0297	Zhangjiakou 5	G-F	
364	0.0485			0.0246	Zhangjiakou 6	G-F	
365	0.0488			0.0343	Hengshui 1	G-F	
366	0.049			0.0259	Hengshui 2	G-F	
367	0.049			0.0268	Hengshui 3	G-F	

(*Continued*)

Table S1. Continued.

No.	Caftaric acid	Chlorogenic acid	Caffeic acid	Cichoric acid	Original site	State	QI
368	0.049			0.0332	Hengshui 4	G-F	
369	0.0493			0.0259	Hengshui 5	G-F	
370	0.0498			0.0281	Baoding 1	G-F	
371	0.0498			0.0369	Baoding 2	G-F	
372	0.05			0.0272	Baoding 3	G-F	
373	0.0503			0.0281	Baoding 4	G-F	
374	0.051			0.0266	Baoding 5	G-F	
375	0.051			0.0268	Xingtai 1	G-F	
376	0.051			0.0272	Xingtai 2	G-F	
377	0.0518			0.0301	Xingtai 3	G-F	
378	0.0521			0.0279	Cangzhou 1	G-F	
379	0.0526			0.0277	Cangzhou 2	G-F	
380	0.0528			0.0478	Cangzhou 3	G-F	
381	0.0536			0.0317	Chongli 1	G-F	
382	0.0536			0.0436	Chongli 2	G-F	
383	0.0538			0.0275	Chongli 3	G-F	
384	0.0538			0.0316	Chengde 1	G-F	
385	0.0538			0.0369	Chengde 2	G-F	
386	0.0538			0.0453	Chengde 3	G-F	
387	0.0541			0.0369	Zunhua 1	G-F	
388	0.0548			0.027	Zunhua 2	G-F	
389	0.0551			0.0257	Zunhua 3	G-F	
390	0.0556			0.0244	Renqiu 1	G-F	
391	0.0556			0.031	Renqiu 2	G-F	
392	0.0556			0.0312	Renqiu 3	G-F	
393	0.0556			0.0323	Shenyang 1	G-F	
394	0.0559			0.0339	Shenyang 2	G-F	
395	0.0559			0.0367	Shenyang 3	G-F	
396	0.0559			0.0392	Dalian 1	G-F	
397	0.0561			0.039	Dalian 3	G-F	
398	0.0564			0.0332	Shandong 1	G-F	
399	0.0564			0.0394	Tanghai 1	N-F	
400	0.0569			0.0361	Tanghai 2	N-F	
401	0.0569			0.039	Tanghai 3	N-F	
402	0.0571			0.0274	Tanghai 4	N-F	
403	0.0576			0.0275	Tanghai 5	N-F	
404	0.0576			0.0469	Tanghai 6	N-F	
405	0.0581			0.0274	Tanghai 7	N-F	
406	0.0581			0.0345	Tanghai 8	N-F	
407	0.0586			0.0263	Tanghai 9	N-F	
408	0.0586			0.0314	Tanghai 10	N-F	
409	0.0594			0.027	Tanghai 11	N-F	
410	0.0599			0.0385	Tanghai 12	N-F	
411	0.0602			0.0299	Luannan 1	N-F	
412	0.0612			0.0338	Luannan 2	N-F	
413	0.0612			0.0339	Luannan 3	N-F	

(*Continued*)

Table S1. Continued.

No.	Caftaric acid	Chlorogenic acid	Caffeic acid	Cichoric acid	Original site	State	QI
414	0.0614			0.0425	Luannan 4	N-F	
415	0.0622			0.0325	Luannan 5	N-F	
416	0.0622			0.0327	Kaiping 1	N-F	
417	0.0627			0.054	Kaiping 2	N-F	
418	0.0632			0.0334	Yixian 1	N-F	
419	0.0632			0.0451	Yixian 2	N-F	
420	0.0632			0.0544	Yixian 3	N-F	
421	0.0637			0.0348	Shexian 1	N-F	
422	0.064			0.0551	Shexian 3	N-F	
423	0.0645			0.0427	Shexian 4	N-F	
424	0.0652			0.0301	Handan 1	N-F	
425	0.0652			0.0303	Handan 2	N-F	
426	0.0655			0.0467	Handan 3	N-F	
427	0.0657			0.031	Handan 4	N-F	
428	0.0657			0.0396	Zhangjiakou 1	N-F	
429	0.066			0.0401	Zhangjiakou 2	N-F	
430	0.066			0.0453	Zhangjiakou 3	N-F	
431	0.067			0.031	Zhangjiakou 4	N-F	
432	0.0673			0.0644	Zhangjiakou 5	N-F	
433	0.0675			0.0332	Zhangjiakou 6	N-F	
434	0.068			0.0325	Hengshui 1	N-F	
435	0.068			0.0533	Hengshui 2	N-F	
436	0.0706			0.037	Hengshui 3	N-F	
437	0.0708			0.0361	Hengshui 4	N-F	
438	0.0721			0.0365	Hengshui 5	N-F	
439	0.0726			0.0365	Baoding 1	N-F	
440	0.0729			0.0358	Baoding 2	N-F	
441	0.0729			0.0491	Baoding 3	N-F	
442	0.0744			0.0363	Baoding 4	N-F	
443	0.0751			0.035	Baoding 5	N-F	
444	0.0754			0.0498	Xingtai 1	N-F	
445	0.0756			0.0516	Xingtai 2	N-F	
446	0.0759			0.0646	Xingtai 3	N-F	
447	0.0762			0.0639	Cangzhou 1	N-F	
448	0.0764			0.0531	Cangzhou 2	N-F	
449	0.0767			0.0317	Cangzhou 3	N-F	
450	0.0772			0.0321	Chongli 1	N-F	
451	0.0782			0.0317	Chongli 2	N-F	
452	0.0805			0.0489	Chongli 3	N-F	
453	0.0825			0.0456	Chengde 1	N-F	
454	0.0833			0.0462	Chengde 2	N-F	
455	0.0863			0.0823	Chengde 3	N-F	
456	0.0893			0.0434	Zunhua 1	N-F	
457	0.0904			0.0736	Zunhua 2	N-F	
458	0.0924			0.0458	Zunhua 3	N-F	
459	0.0926			0.0451	Renqiu 1	N-F	

(*Continued*)

Table S1. Continued.

No.	Caftaric acid	Chlorogenic acid	Caffeic acid	Cichoric acid	Original site	State	QI
460	0.0926			0.0465	Renqiu 2	N-F	
461	0.0931			0.0487	Renqiu 3	N-F	
462	0.0934			0.0474	Shenyang 1	N-F	
463	0.0937			0.0462	Shenyang 2	N-F	
464	0.0939			0.0467	Shenyang 3	N-F	
465	0.1226			0.0593	Dalian 1	N-F	
466	0.1231			0.0595	Dalian 2	N-F	
467	0.1251			0.0608	Dalian 3	N-F	
468	0.1279			0.0387	Shandong 1	N-F	
469	0.1297			0.0394	Shandong 2	N-F	
470	0.1325			0.0398	Shandong 3	N-F	
471		0.2292	0.0208		Tanghai 1	S-A	
472		0.2302	0.0213		Tanghai 2	S-A	
473		0.2309	0.0386		Tanghai 3	S-A	
474		0.2334	0.0217		Tanghai 4	S-A	
475		0.2339	0.0229		Tanghai 5	S-A	
476		0.2218	0.0238		Tanghai 6	S-A	
477		0.2226	0.0247		Tanghai 7	S-A	
478		0.2206	0.0269		Tanghai 8	S-A	
479		0.2206	0.0261		Luannan 1	S-A	
480		0.212	0.0181		Luannan 2	S-A	
481		0.2128	0.0214		Luannan 3	S-A	
482		0.2408	0.0303		Luannan 4	S-A	
483		0.2499	0.0201		Luannan 5	S-A	
484		0.2499	0.0214		Kaiping 1	S-A	
485		0.251	0.0559		Kaiping 2	S-A	
486		0.2548	0.0216		Kaiping 3	S-A	
487		0.2549	0.0224		Yixian 1	S-A	
488		0.261	0.0214		Yixian 2	S-A	
489		0.2646	0.0222		Yixian 4	S-A	
490		0.2669	0.0214		Yixian 6	S-A	
491		0.2713	0.0294		Shexian 1	S-A	
492		0.3766	0.0013		Shexian 2	S-A	
493		0.3785	0.0253		Shexian 3	S-A	
494		0.3797	0.0252		Shexian 4	S-A	
495		0.418	0.0229		Shexian 5	S-A	
496		0.44	0.0197		Handan 1	S-A	
497		0.4469	0.0305		Handan 3	S-A	
498		0.4538	0.03		Handan 4	S-A	
499		0.4953	0.029		Zhangjiakou 1	S-A	
500		0.5337	0.0142		Zhangjiakou 2	S-A	
501		0.2846	0.0305		Zhangjiakou 3	S-A	
502		0.2858	0.0219		Hengshui 1	S-A	
503		0.2892	0.0273		Hengshui 5	S-A	
504		0.2911	0.0392		Xingtai 1	S-A	
505		0.2912	0.0225		Xingtai 2	S-A	

(*Continued*)

Table S1. Continued.

No.	Caftaric acid	Chlorogenic acid	Caffeic acid	Cichoric acid	Original site	State	QI
506		0.2927	0.0309		Cangzhou 1	S-A	
507		0.2937	0.0465		Cangzhou 3	S-A	
508		0.2956	0.0229		Chongli 1	S-A	
509		0.2973	0.0243		Chongli 3	S-A	
510		0.2983	0.0232		Baoding 1	S-A	
511		0.3018	0.0241		Baoding 3	S-A	
512		0.3165	0.0235		Chengde 1	S-A	
513		0.3197	0.0247		Chengde 2	S-A	
514		0.332	0.0228		Zunhua 1	S-A	
515		0.3357	0.0232		Zunhua 2	S-A	
516		0.3527	0.0285		Zunhua 3	S-A	
517		0.3534	0.0284		Renqiu 1	S-A	
518		0.273	0.0219		Renqiu 3	S-A	
519		0.2745	0.0125		Shenyang 1	S-A	
520		0.2784	0.0208		Shenyang 3	S-A	
521		0.2787	0.0249		Dalian 1	S-A	
522		0.047	0.0256		Dalian 3	S-A	
523		0.0679	0.0095		Shandong 1	S-A	
524		0.0524	0.0216		Shandong 3	S-A	
525		0.0755	0.0286		Tanghai 1	G-A	
526		0.0779	0.0367		Tanghai 2	G-A	
527		0.0694	0.0256		Tanghai 3	G-A	
528		0.0802	0.0454		Tanghai 4	G-A	
529		0.1441	0.015		Tanghai 5	G-A	
530		0.1459	0.0237		Tanghai 6	G-A	
531		0.1724	0.0253		Tanghai 7	G-A	
532		0.1829	0.0155		Tanghai 8	G-A	
533		0.18	0.0253		Luannan 1	G-A	
534		0.1692	0.0244		Luannan 2	G-A	
535		0.1697	0.0246		Luannan 3	G-A	
536		0.17	0.0234		Luannan 4	G-A	
537		0.1655	0.0089		Luannan 5	G-A	
538		0.1658	0.0226		Kaiping 1	G-A	
539		0.0294	0.018		Kaiping 2	G-A	
540		0.0294	0.023		Kaiping 3	G-A	
541		0.0336	0.0106		Yixian 1	G-A	
542		0.0336	0.0134		Yixian 2	G-A	
543		0.0338	0.0184		Yixian 4	G-A	
544		0.0363	0.0012		Yixian 6	G-A	
545		0.0394	0.0205		Shexian 1	G-A	
546		0.0438	0.0244		Shexian 2	G-A	
547		0.0417	0.0258		Shexian 3	G-A	
548		0.0138	0.0142		Shexian 4	G-A	
549		0.0151	0.0264		Shexian 5	G-A	
550		0.0152	0.0455		Handan 1	G-A	
551		0.0268	0.011		Handan 3	G-A	

(*Continued*)

Table S1. Continued.

No.	Caftaric acid	Chlorogenic acid	Caffeic acid	Cichoric acid	Original site	State	QI
552		0.0244	0.0186		Handan 4	G-A	
553		0.0231	0.0276		Zhangjiakou 1	G-A	
554		0.0192	0.0178		Zhangjiakou 2	G-A	
555		0.0182	0.0243		Zhangjiakou 3	G-A	
556		0.0088	0.0115		Hengshui 1	G-A	
557		0.0091	0.0146		Hengshui 5	G-A	
558		0.0107	0.0213		Xingtai 1	G-A	
559		0.0109	0.0128		Xingtai 2	G-A	
560		0.0115	0.0109		Cangzhou 1	G-A	
561		0.0121	0.0172		Cangzhou 3	G-A	
562		0.0129	0.0158		Chongli 1	G-A	
563		0.005	0.008		Chongli 3	G-A	
564		0.0062	0.0209		Baoding 1	G-A	
565		0.0072	0.0112		Baoding 3	G-A	
566		0.0077	0.0296		Chengde 1	G-A	
567		0.2019	0.0238		Chengde 2	G-A	
568		0.2032	0.0208		Zunhua 1	G-A	
569		0.2049	0.0204		Zunhua 2	G-A	
570		0.2056	0.0223		Zunhua 3	G-A	
571		0.1987	0.001		Renqiu 1	G-A	
572		0.1965	0.0229		Renqiu 3	G-A	
573		0.197	0.0226		Shenyang 1	G-A	
574		0.0839	0.01		Shenyang 3	G-A	
575		0.0791	0.0394		Dalian 1	G-A	
576		0.1739	0.019		Dalian 3	G-A	
577		0.0406	0.0225		Shandong 1	G-A	
578		0.019	0.0389		Shandong 3	G-A	

Remarks:
No. 1-324, self-checked with four indices, and gave quality evaluation (QI);
No. 325-329, three indices checked by Institute of Quality Standard and Testing Technology for Agro-products of CAAS, Beijing, China;
No. 330-470, two indices checked by Institute of Quality Standard and Testing Technology for Agro-products of CAAS, Beijing, China;
No. 471-578, two indices checked by Pony Testing International Group – Beijing Testing Centre, Beijing, China.
State: dandelion samples were collected from different land-types and harvested in different seasons
S: Saline-alkali land, soil salt content around 0.3%
N: Common field, loam
G: Greenhouse
A: Spring season, April–May
F: Fall season, September–October
Original site: Dandelion resource was collected from its habitat, and given a name with the form of “city + sample number”.
QI, quality index.

Table S2. Matching numbers of various compounds with reference fingerprint.

No.	RT	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	Reference fingerprint	RSD (%) of RT	RSD (%) of peak area	Matching numbers of peak
1	2.318	0	0	0	0	0	0	0	0	8.63	0	0	0	0	0	0	0.575	0	0	1
2	2.541	0	0	0	0	0	0	0	0	6.331	0	21.9	14.973	0	0	0	2.88	1.3	54.16	3
3	2.688	0	0	0	0	0	0	0	0	9.236	0	0	0	0	0	0	0.616	0	0	1
4	3.056	0	0	0	0	0	0	0	0	0	22.975	8.39	0	0	0	22.975	3.623	0.35	46.49	3
5	3.237	8.724	0	0	0	0	6.603	0	0	7.313	0	5.175	0	0	0	0	1.854	1.37	21.25	4
6	3.369	11.109	0	0	0	0	0	0	0	0	0	8.688	0	0	0	0	1.32	1.31	17.3	2
7	3.546	0	0	0	0	0	0	0	0	0	0	5.155	0	0	0	0	0.344	0	0	1
8	3.711	6.551	0	8.155	7.964	0	7.324	0	0	13.008	0	8.024	0	0	0	0	3.402	0.39	26.89	6
9	4.261	58.823	44.069	40.544	59.498	39.897	55.235	79.784	29.548	42.652	47.433	78.453	81.856	30.968	44.163	47.433	52.024	0	32.3	15
10	4.737	8.152	9.173	7.001	7.464	6.891	7.127	8.565	8.324	9.102	7.778	16.782	9.995	6.451	7.222	7.778	5.988	0	32.21	15
11	5.521	0	0	6.632	7.234	0	0	0	7.214	0	0	0	0	0	0	0	1.933	0.05	13.22	3
12	6.082	16.932	8.53	17.211	14.888	15.773	11.236	14.381	11.564	13.326	10.901	14.922	15.469	8.918	15.604	10.901	13.37	0	21.12	15
13	6.264	0	0	0	5.678	0	0	0	0	0	0	6.214	0	0	7.721	0	0	1.23	0	3
14	6.913	0	9.345	10.343	12.234	0	0	23.563	0	0	0	12.342	18.232	0	0	0	3.237	1.512	15.1	6
15	7.198	0	9.234	0	0	0	0	5.61	0	0	0	0	0	0	0	7.507	1.818	0.25	14.41	3
16	10.012	15.601	50.93	14.225	36.09	19.228	28.025	70.559	10.246	18.551	44.01	68.768	74.05	10.69	25.134	44.01	35.341	0.07	63.37	15
17	10.256	0	7.213	0	0	0	0	6.324	0	0	0	0	8.233	0	0	0	1.257	0.45	13.32	3

RT, retention time; RSD, relative standard deviation.