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Clinical Application and Dosage of *Glehniae Radix* in the Treatment of Dryness Syndrome

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Abstract: *Objective:* To review the evidence from classical formulas, the prescribing experience of renowned traditional Chinese medicine (TCM) physicians, and dose-effect research on *Glehniae Radix* for dryness syndrome, and to summarize its principal clinical applications, dosage ranges, and major compatibility strategies, thereby informing dose-effect research and syndrome-differentiated prescribing of Chinese medicinals for dryness syndrome. *Methods:* Ancient formularies, the clinical experience of renowned TCM physicians and contemporary clinicians, dose-effect studies of formulas and individual medicinals, and recent pharmacological studies were reviewed. The botanical origin, actions, dosage, safety, and cited literature of *Glehniae Radix* were checked against the Chinese Pharmacopoeia, and the manuscript was reorganized to reduce repetition. *Results: Glehniae Radix* is the dried root of *Glehnia littoralis Fr. Schmidt ex Miq.* (Apiaceae). It nourishes Yin and clears the lung, benefits the stomach, and generates body fluids. The dosage specified in the Chinese Pharmacopoeia is 5–12 g. In classical formulas, the converted dosage of Shashen is generally 7.5–11.25 g, whereas modern decoctions commonly use 9–15 g. In cases of severe fluid depletion, pronounced dryness-heat, Sjögren's syndrome, post-radiotherapy or post-chemotherapy fluid depletion, or long-standing wasting-thirst characterized by Qi and Yin deficiency, the dosage may be increased to 15–30 g when warranted by syndrome differentiation. Major compatibility strategies include clearing and nourishing the lung and stomach, moistening the lung and relieving cough, benefiting the Stomach and generating body fluids, nourishing Yin and clearing heat, supplementing Qi and nourishing Yin, moistening dryness and unblocking the collaterals, relieving pharyngeal discomfort and restoring the voice, and nourishing Yin and calming the spirit. *Conclusion:* The use of *Glehniae Radix* for dryness syndrome centers on regulating the Lung and Stomach together, moistening and nourishing with sweet-cold medicinals, and combining clearing with supplementation. The dosage should be individualized according to disease location, severity of fluid depletion, cold-heat and deficiency-excess patterns, accompanying syndromes, and the properties of coadministered medicinals. When a high dose is considered, Spleen-Stomach tolerance and balancing combinations should be taken into account.

Keywords: *Glehniae Radix*; Chinese medicinal for dryness syndrome; clinical application; dosage study; compatibility pattern; dose-effect relationship

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1. Introduction

Glehniae Radix is sweet and slightly bitter in flavor and slightly cold in nature. It enters the lung and stomach meridians and nourishes Yin, clears the lung, benefits the stomach, and generates body fluids. It is commonly used to treat dryness-related conditions, including dry cough due to lung dryness, stomach Yin deficiency, fluid depletion after febrile disease, dryness impediment (Zaobi), and wasting-thirst (Xiaoke) syndrome [1]. Studies have identified polysaccharides, coumarins, polyacetylenes, lignans, phenolic acids, and other constituents in *Glehniae Radix*. Pharmacological studies have reported immunomodulatory, anti-inflammatory, antioxidant, antitumor, hypoglycemic, and gastroprotective activities [2-3]. Because of its sweet, cold, and moistening properties, *Glehniae Radix* can nourish lung Yin and clear lung heat while benefiting Stomach Yin and generating body fluids. It therefore plays a central role in strategies that clear and nourish the lung and stomach in the treatment of dryness syndrome.

Glehniae Radix and *Adenophorae Radix* (Nanshashen) are both known as Shashen, but they differ in botanical origin and therapeutic emphasis. Ancient formularies often did not distinguish between the northern and southern types of Shashen, whereas modern clinical practice should select the appropriate medicinal according to the formula's therapeutic purpose, disease location, and syndrome pattern. *Glehniae Radix* may be preferred for depletion of lung and stomach fluids manifested by dry cough with scanty sputum, dry throat and thirst, or stomach Yin deficiency because of its sweet, slightly cold, and moistening properties. When phlegm-heat is more pronounced and the lung's dispersing and descending functions are impaired, *Adenophorae Radix* or other medicinals that clear the lung and resolve phlegm may be considered. Although *Glehniae Radix* is relatively mild, its dosage should still be tailored to the clinical indication. Dose-effect research on formulas emphasizes that the dose of an individual medicinal is not ancillary information but an important variable affecting the direction and intensity of therapeutic action and the margin of safety [4]. This article reviews changes in the dosage and compatibility of *Glehniae Radix* in classical formulas, the experience of renowned TCM physicians, and modern clinical practice to clarify its use in dryness syndrome, support syndrome-differentiated dosing, and inform further dose-effect research.

2. Dosage and compatibility in classical formulas

Ancient physicians used Shashen with different medicinals to treat dryness patterns such as lung and stomach Yin deficiency, dry cough, stomach Yin insufficiency, liver and kidney Yin deficiency, and warm-dryness injury to the Lung. In Yiguan Jian recorded in the Qing-dynasty Xu Mingyi Lei'an, Shashen at 3 Qian (approximately 11.25 g) nourishes Yin and generates body fluids. It is combined with *Rehmanniae Radix*, *Ophiopogonis Radix*, *Lycii Fructus*, *Angelicae Sinensis Radix*, and *Toosendan Fructus* to treat chest, hypochondriac, and epigastric pain, acid regurgitation, bitter vomiting, and dryness of the throat and mouth due to liver and kidney Yin deficiency with constrained liver Qi [5]. In Shashen Maidong Tang from the Qing-dynasty Wenbing Tiaobian, Shashen at 3 Qian (approximately 11.25 g) clears and nourishes the Lung and Stomach, generates body fluids, and moistens dryness. It is combined with *Ophiopogonis Radix*, *Polygonati Odorati Rhizoma*, *Trichosanthis Radix*, *Mori Folium*, *Lablab Semen Album*, and *Glycyrrhizae Radix et Rhizoma* to treat dryness injury to the Yin aspect of the lung and stomach, manifested by dry cough with scanty sputum, dry throat, thirst, and a red tongue with a scanty coating [6]. In Yiwei Tang from the same text, Shashen at 3 Qian (approximately 11.25 g) nourishes Yin, benefits the stomach, generates body fluids, and relieves thirst. Combined with *Ophiopogonis Radix*, *Rehmanniae Radix*, *Polygonati Odorati Rhizoma*,

and rock sugar, it is used for stomach Yin injury following Yangming warm disease, with hunger without desire to eat, dryness of the mouth and throat, and epigastric discomfort [6]. In Sangxing Tang, also from Wenbing Tiaobian, Shashen at 2 Qian (approximately 7.5 g) moistens the lung and generates body fluids. It is combined with *Mori Folium*, *Armeniacae Semen Amarum*, *Fritillariae Thunbergii Bulbus* (Xiangbei), *Sojae Semen Praeparatum*, *Gardeniae Fructus*, and pear peel to treat warm dryness invading the lung, manifested by dry cough with scanty sputum, dry throat, thirst, and mild fever [6]. The original Qingzao Jiufei Tang in the Qing-dynasty Yimen Falü contains *Ginseng Radix et Rhizoma*; in modern practice, it is often replaced with *Glehniae Radix* or *Panacis Quinquefolii Radix* to supplement Qi, nourish Yin, clear dryness, and moisten the lung. Combined with *Mori Folium*, *Gypsum Fibrosum*, *Ophiopogonis Radix*, *Asini Corii Colla*, *Armeniacae Semen Amarum*, and sesame seed, it is used for severe warm-dryness injury to the lung manifested by dry cough without sputum, dyspnea or wheezing associated with rebellious lung Qi, and dryness of the throat and nose [7].

In classical formulas, Shashen is primarily used to clear and nourish the Lung and Stomach, nourish Yin and generate body fluids, moisten dryness and relieve cough, and benefit the Stomach and harmonize the middle jiao. Dosages are concentrated between 7.5 and 11.25 g, a range broadly consistent with the dosage specified in the Chinese Pharmacopoeia. This pattern suggests that routine use should emphasize the mild, moistening properties of *Glehniae Radix*. For long-standing disease with substantial Yin depletion or concurrent Qi and Yin deficiency and severe depletion of Lung and Stomach fluids, contemporary physicians may increase the dose according to syndrome differentiation.

3. Dosage and compatibility in the experience of renowned TCM physicians

3.1. Lu Zhizheng

Lu Zhizheng introduced the disease name dryness impediment (Zaobi). He emphasized that although Sjögren's syndrome is characterized by marked depletion of body fluids, treatment should not rely solely on rich, cloying Yin-nourishing and dryness-moistening medicinals; it should also address spleen and stomach transportation and transformation and the source of fluid production. For dryness injury to stomach Yin with impaired spleen and stomach function, he often used sweet-cool, moistening medicinals to nourish the spleen and benefit the stomach. *Glehniae Radix* was combined with *Ophiopogonis Radix*, *Dioscoreae Rhizoma*, stir-fried *Lablab Semen Album*, *Paeoniae Radix Alba*, *Cannabis Fructus*, *Rosae Rugosae Flos*, germinated rice, and malt to nourish Yin without impairing the middle jiao and to moisten dryness while supporting transportation and transformation. The usual empirical dosage was 10–15 g [8]. This experience suggests that when *Glehniae Radix* is used for dryness impediment, treatment should address spleen and stomach intake and transformation rather than focus only on moistening, because prolonged use of sweet-cold, softening medicinals may impair the middle jiao.

3.2. Jin Shi

Jin Shi emphasized the pathogenesis of Yin deficiency with collateral stagnation and impaired dispersal of lung Qi in Sjögren's syndrome, and treated it by nourishing Yin, unblocking the collaterals, dispersing lung Qi, and promoting the distribution of body fluids. The *Ophiopogonis Radix–Glehniae Radix* pair was central to his prescriptions. The former primarily benefits the Stomach, generates body fluids, nourishes Yin, and moistens the lung, whereas the latter clears and nourishes the lung and stomach, moistens dryness,

and generates body fluids. Together, they support fluid generation through the functional regulation of both the lung and stomach. They were used with pairs such as *Asteris Radix et Rhizoma–Glycyrrhizae Radix et Rhizoma*, *Paeoniae Radix Rubra–Chuanxiong Rhizoma*, *Liquidambaris Fructus–Clematidis Radix et Rhizoma*, *Gypsum Fibrosum–Moutan Cortex*, and *Mume Fructus–Glycyrrhizae Radix et Rhizoma*, creating a prescribing pattern that nourishes Yin, disperses lung Qi, unblocks the collaterals, clears heat, and uses sour and sweet medicinals to generate Yin [9]. Although this report did not center on the dose of a single medicinal, the combinations show that *Glehniae Radix* is not merely a Yin-nourishing medicinal in the treatment of dryness impediment; it also helps disperse lung Qi, distribute body fluids, moisten dryness, and unblock the collaterals.

3.3. Zhang Zhiwen

Zhang Zhiwen considered fluid depletion leading to dryness to be the basic pathogenesis of Sjögren's syndrome, with Yin deficiency as the root and dryness-heat as the manifestation, particularly involving the liver and stomach. His treatment was not limited to nourishing Yin and clearing heat; he often combined Qi-supplementing medicinals such as *Astragali Radix* and *Codonopsis Radix* to supplement Qi, generate body fluids, and promote the distribution of fluids through Qi movement. In a representative case of Yin deficiency and dryness-heat with Qi deficiency, he prescribed *Astragali Radix* 45 g, *Codonopsis Radix* 30 g, and *Glehniae Radix* 30 g with *Ophiopogonis Radix*, *Anemarrhenae Rhizoma*, *Phragmitis Rhizoma*, *Polygonati Odorati Rhizoma*, *Rehmanniae Radix*, *Mori Folium*, *Prunellae Spica*, and *Ligustri Lucidi Fructus* for dry mouth with polydipsia, dry and stinging eyes, and easy fatigability [10]. This dosing pattern suggests that 30 g of *Glehniae Radix* is more appropriate for severe or chronic dryness patterns with substantial fluid depletion and concurrent Qi and Yin deficiency. It should be combined with medicinals that supplement Qi, clear heat, nourish Yin, and strengthen the Spleen rather than treated as a routine dose.

3.4. Zhou ZhongYing

Zhou ZhongYing emphasized that deficiency may give rise to excess and that deficiency and excess may coexist in lung cancer. He advocated supporting healthy Qi without causing stagnation and eliminating pathogenic factors without using excessively harsh methods. Lung cancer and the postoperative, post-radiotherapy, and post-chemotherapy periods commonly involve injury to both Qi and Yin and depletion of lung and stomach fluids. Zhou often combined *Glehniae Radix* with *Adenophorae Radix*, *Asparagi Radix*, *Ophiopogonis Radix*, *Pseudostellariae Radix*, *Anemarrhenae Rhizoma*, *Ligustri Lucidi Fructus*, *Ecliptae Herba*, and *Lycii Fructus* to supplement Qi, nourish Yin, moisten the lung, and generate body fluids. *Glehniae Radix* was generally used at 12 g and often combined with 12 g of *Adenophorae Radix*; the dose could be adjusted within 10–15 g when necessary [12-13]. He did not seek an aggressively high dose but emphasized preserving the free movement of stomach Qi within a group of Yin-nourishing medicinals, reflecting the principles of supporting healthy Qi without retaining pathogenic factors and nourishing Yin without impairing the middle jiao.

3.5. Shi Jinmo

Shi Jinmo often combined *Adenophorae Radix* and *Glehniae Radix*, drawing on the former to clear the lung and resolve phlegm and on the latter to nourish Yin and generate body fluids. For Sjögren's syndrome, lung Yin depletion, dry cough, and fluid injury after febrile disease, the two medicinals were used together to

strengthen the effects of nourishing Yin, moistening the lung, clearing heat, and relieving thirst. In lobar pneumonia with heat obstructing the lung, Shi did not simply add multiple sweet-cold medicinals. He first dispersed lung Qi, cleared heat, resolved phlegm, and relieved wheezing, and then added Shashen medicinals to moisten the Lung, generate body fluids, harmonize the stomach, and protect Yin. *Glehniae Radix* was commonly used at 10–12 g, or *Glehniae Radix* and *Adenophorae Radix* were each used at 10 g. In the recovery stage of pulmonary tuberculosis with marked Qi and Yin deficiency, *Glehniae Radix* could be increased to 30 g and combined with Qi-supplementing medicinals such as *Astragali Radix* and *Codonopsis Radix* to supplement both Qi and Yin [14-15].

3.6. Yan Zhenghua

Yan Zhenghua emphasized the transformation among wind, heat, dryness, and phlegm in the diagnosis and treatment of cough. For persistent cough with pronounced signs of dryness, he combined clearing and dispersing methods with moistening and nourishing methods and avoided excessive use of bitter-cold medicinals that could injure the Lung and Stomach. *Glehniae Radix* was commonly combined with *Mori Folium*, *Sojae Semen Praeparatum*, *Armeniacae Semen Amarum*, *Fritillariae Thunbergii Bulbus*, *Gardeniae Fructus*, and pear peel to clear and disperse warm dryness, moisten the lung, and relieve cough. When dry throat, scanty sputum, and a red tongue with scanty fluid were prominent, *Ophiopogonis Radix* and *Trichosanthis Radix* were added to strengthen fluid generation and moisten dryness. *Glehniae Radix* was generally used at 8–10 g and could be increased to 10–15 g when dry cough was pronounced [16-17]. This moderate range is suitable for external dryness entering the lung, early injury to lung fluids, or relatively mild Yin injury after a prolonged cough.

3.7. Deng Tietao

Deng Tietao advocated the theory of the interrelationship of the five zang organs. In treating wasting-thirst syndrome and dryness patterns, he considered both the Spleen and Stomach as sources of fluid transformation and depletion of Liver and Kidney Yin. *Glehniae Radix* was commonly combined with *Ophiopogonis Radix*, *Trichosanthis Radix*, *Dendrobii Caulis*, and *Rehmanniae Radix* to nourish lung and stomach Yin, with *Dioscoreae Rhizoma*, *Astragali Radix*, and other medicinals added as appropriate to strengthen the spleen and supplement Qi. This approach supports fluid generation without relying excessively on cold medicinals. The usual dosage was 9–12 g and could be increased to 12–15 g when dry mouth, thirst, Yin deficiency, and dryness-heat were pronounced [18-19]. This experience suggests that treating wasting-thirst syndrome with *Glehniae Radix* involves restoring the distribution of body fluids through coordinated regulation of the lung, stomach, and spleen rather than merely clearing stomach heat.

3.8. Jiao Shude

Jiao Shude held that although Shashen is described as nourishing the Yin of the five zang organs, its principal role is to nourish lung and stomach Yin. For lung Yin insufficiency manifested by dry cough with scanty sputum, dry throat, hoarseness, and blood-streaked sputum, it may be combined with *Rehmanniae Radix*, *Ophiopogonis Radix*, *Fritillariae Cirrhosae Bulbus*, and *Lilii Bulbus*. When dryness-heat is more pronounced, it may be combined with *Mori Folium*, *Scrophulariae Radix*, *Gypsum Fibrosum*, *Anemarrhenae Rhizoma*, and *Asini Corii Colla*. The dosage ranges broadly from 4.5 to 12 g, reflecting mild clearing and

moistening with dosage increases according to syndrome severity [20-21].

4. Dosage and compatibility in dose-effect research

Dose-effect research on formulas seeks to explain differences in effect arising from different doses of the same medicinal and from different combinations at the same dose. For *Glehniae Radix*, changes in dosage primarily affect the strength of its clearing and nourishing actions and the degree of fluid supplementation. Conventional doses clear and nourish the lung and stomach, moisten dryness, and generate body fluids; moderate doses strengthen the effects of benefiting the Stomach, generating body fluids, moistening the lung, and relieving cough; larger doses are more often used in chronic disease with pronounced dryness-heat, substantial depletion of Yin fluids, or deficiency of both Qi and Yin. These dose changes must be assessed in the context of the syndrome pattern, the combination of medicinals, and the patient's Spleen-Stomach tolerance rather than in isolation from the formula and pattern [4].

4.1. Tong Xiaolin

Tong Xiaolin emphasizes state-target syndrome differentiation in treating type 2 diabetes and its complications. When the disease progresses to depletion of the Yin aspect with unresolved dryness-heat, he often combines *Glehniae Radix* with *Rehmanniae Radix*, *Scrophulariae Radix*, *Trichosanthis Radix*, *Lycii Cortex*, and *Moutan Cortex* to nourish Yin, clear heat, generate body fluids, and relieve thirst. The *Glehniae Radix* dose is higher than the conventional range, generally 15–30 g, for marked fluid depletion manifested by thirst, dry mouth, and a red tongue with scanty fluid [22-23]. This high dose is not used in isolation. It is reserved for clearly identified target manifestations such as dryness-heat, Yin deficiency, and thirst in wasting-thirst syndrome, and it should be adjusted according to Spleen and Stomach transportation and transformation and the patient's cold-heat tendency.

4.2. Li Saimei

Li Saimei treats Qi and Yin deficiency in the later stages of diabetes with *Glehniae Radix* combined with *Ophiopogonis Radix*, *Schisandrae Chinensis Fructus*, and *Rehmanniae Radix* to supplement Qi, nourish Yin, generate body fluids, and relieve thirst. *Glehniae Radix* nourishes Yin without being cloying and clears heat without being excessively cold, making it suitable for long-standing wasting thirst accompanied by dry mouth and fatigue. The clinical dosage is generally 15–20 g [24]. Whereas Tong Xiaolin emphasizes target manifestations of Yin deficiency and dryness-heat, Li Saimei places greater emphasis on Qi and Yin deficiency in the later stages of diabetes. *Glehniae Radix* is therefore combined with medicinals that astringe and generate body fluids and supplement Qi and nourish Yin, achieving supplementation without stagnation and moistening with conservation.

4.3. Fan Jiping

Fan Jiping approaches insomnia through the heart and liver. He holds that prolonged illness and insomnia may deplete heart and liver Yin; when Yin and body fluids are insufficient, the spirit lacks nourishment and the ethereal soul is not secured. Although *Glehniae Radix* primarily enters the lung and stomach, the lung governs the vessels and the stomach is a source of Qi and blood production. Restoring lung and stomach Yin may therefore help nourish the Heart and Liver. *Glehniae Radix* is often combined with *Rehmanniae*

Radix, *Ophiopogonis Radix*, *Ziziphi Spinosae Semen*, *Polygalae Radix*, and *Salviae Miltiorrhizae Radix et Rhizoma* to nourish Yin, soften the liver, clear the heart, and calm the spirit. The dosage of *Glehniae Radix* is approximately 15 g [25]. In this setting, *Glehniae Radix* is not used as a direct spirit-calming medicinal; it supports treatment of insomnia associated with Yin deficiency and internal heat by nourishing the lung and stomach and replenishing the source of Yin fluids, together with medicinals that nourish the heart, soften the liver, and invigorate blood.

4.4. Dose-effect implications

The preceding clinical experience suggests three dosage levels for *Glehniae Radix* in dose-effect research. First, 9–12 g is a conventional clearing and nourishing dose for mild injury to lung and stomach Yin, cough due to warm dryness, dryness of the throat and mouth, or early stomach Yin deficiency. Second, 15–20 g is an enhanced fluid-generating dose for wasting-thirst syndrome, dryness impediment, Qi and Yin deficiency after chronic disease, or substantial fluid depletion. Third, 20–30 g is an increased dose used according to syndrome differentiation, most often in Sjögren's syndrome, fluid depletion after cancer radiotherapy or chemotherapy, or wasting-thirst with prominent thirst. At the highest range, *Glehniae Radix* should be combined with medicinals that supplement Qi, strengthen the Spleen, clear heat, or protect the Stomach, and patients should be monitored closely for poor appetite, abdominal distension, loose stools, and other signs of intolerance.

5. Dosage and compatibility in modern clinical practice

5.1. Compatibility with *Ophiopogonis Radix* and *Mori Folium*

Glehniae Radix combined with *Ophiopogonis Radix* and *Mori Folium* is commonly used for Yin-deficiency dry cough, chronic bronchitis with persistent cough and scanty sputum, and unresolved fluid depletion in the later stage of external dryness invading the lung. Wan Qinan emphasized the relationship between lung dryness and fluid deficiency, impaired dispersing and descending function of the lung, and Yin injury from prolonged cough in chronic bronchitis. He often used *Glehniae Radix*, *Ophiopogonis Radix*, and *Mori Folium* together: *Glehniae Radix* is sweet and cold and clears and nourishes the lung and stomach; *Ophiopogonis Radix* nourishes Yin, moistens the lung, benefits the stomach, and generates body fluids; and *Mori Folium* gently clears and disperses lung Qi and dispels dryness-heat. The combination balances clearing and dispersing with nourishment and moistening, and may alleviate dry cough, scanty sputum, and dry throat without causing cloying obstruction of the Lung. In his practice, *Glehniae Radix* was generally used at 12–15 g, *Ophiopogonis Radix* at 15 g, and *Mori Folium* at 10 g [26]. For sticky sputum that is difficult to expectorate, *Fritillariae Cirrhosae Bulbus*, *Trichosanthis Fructus*, and *Platycodonis Radix* may be added. For chronic Qi deficiency with exertional dyspnea, small amounts of *Astragali Radix* and *Pseudostellariae Radix* may be added to supplement Qi and generate body fluids. This combination is suited to dryness without marked excess and cough with scanty sputum; it is inappropriate to rely heavily on sweet-cold moistening medicinals when phlegm-dampness is abundant and the tongue coating is greasy.

5.2. Compatibility with *Dendrobii Caulis* and *Paeoniae Radix Alba*

Glehniae Radix combined with *Dendrobii Caulis* and *Paeoniae Radix Alba* is commonly used for chronic gastritis, chronic atrophic gastritis, gastric ulcer, and functional dyspepsia attributed to stomach Yin

insufficiency and disharmony between the liver and stomach. In treating chronic gastric disorders, Yao Xixian emphasized that a prolonged gastric disorder may injure Yin, obstruct the collaterals, and disrupt Qi movement. For dull or burning epigastric pain, a gnawing sensation, dryness of the mouth and throat, poor appetite and dry stools, and a red tongue with scanty fluid, he used stomach-benefiting, Yin-nourishing medicinals such as *Glehniae Radix* and *Dendrobii Caulis* as the foundation and combined them with *Paeoniae Radix Alba* to nourish blood, preserve Yin, soften the liver, relieve spasm, and alleviate pain. This approach aims both to restore stomach Yin and to relax the stomach collaterals [27]. *Glehniae Radix* benefits the stomach, generates body fluids, and clears and nourishes the lung and stomach; *Dendrobii Caulis* excels at nourishing stomach Yin and moistening the stomach collateral; and *Paeoniae Radix Alba* combines sour and sweet properties to generate Yin, relieve spasm, and alleviate pain. The three-medicinal combination is suitable for stomach Yin insufficiency with constricting epigastric pain. *Glehniae Radix* is commonly used at 10–25 g [27]. Fo-Shou, *Citri Fructus*, and *Citri Reticulatae Pericarpium* or other gently Qi-regulating medicinals may be added for pronounced epigastric distension and belching. *Salviae Miltiorrhizae Radix et Rhizoma* may be added to invigorate blood and unblock the collaterals when prolonged disease enters the collaterals and pain is fixed. Although the combination primarily nourishes Yin, excessive cloying should be avoided, and the dose of sweet-cold medicinals should be reduced in spleen and stomach deficiency-cold with loose stools and poor appetite.

5.3. Compatibility with *Rehmanniae Radix* and *Trichosanthis Radix*

Glehniae Radix combined with *Rehmanniae Radix* and *Trichosanthis Radix* is used primarily for wasting-thirst syndrome, diabetes, and related patterns of dryness-heat and fluid depletion. Lü Renhe emphasized Yin deficiency as the root, dryness-heat as the manifestation, and disordered fluid metabolism in the upper, middle, and lower jiao involving the lung, stomach, and kidney [28]. He often combined *Glehniae Radix* with *Rehmanniae Radix* and *Trichosanthis Radix* to nourish Yin, clear heat, generate body fluids, and relieve thirst. *Glehniae Radix* principally nourishes lung and stomach Yin and may alleviate dryness of the mouth and throat and insufficiency of stomach fluids. *Rehmanniae Radix* nourishes Yin, clears heat, cools blood, and generates body fluids while also supporting Yin fluids in the lower jiao. *Trichosanthis Radix* clears heat, generates body fluids, moistens dryness, and relieves thirst, particularly in patients with polydipsia and a red tongue with scanty fluid. Together, the three medicinals replenish fluids through the lung and stomach and clear dryness-heat. The combination may be considered when wasting-thirst is accompanied by dry mouth, thirst, vexing heat in the five centers, or a red tongue with a scanty coating. *Glehniae Radix* is generally used at 10–20 g [28]. *Astragali Radix*, *Dioscoreae Rhizoma*, and *Pseudostellariae Radix* may be added for marked Qi and Yin deficiency; *Anemarrhenae Rhizoma*, *Scrophulariae Radix*, and *Lycii Cortex* may be added when dryness-heat is pronounced; and high doses of sweet-cold medicinals should be used cautiously when the spleen and stomach are weak and stools are loose.

5.4. Compatibility with Astragali Radix and *Codonopsis Radix*

The combination of *Glehniae Radix* with *Astragali Radix* and *Codonopsis Radix* reflects the strategy of supplementing Qi to generate body fluids and strengthening the spleen to support the lung. It is used for Qi and Yin deficiency during recovery from respiratory disease, in chronic lung disease, and after cancer treatment. Tian Fanian and colleagues surveyed TCM symptoms in patients recovering from coronavirus

disease 2019 and found that cough, fatigue, dryness of the mouth and throat, and reduced appetite were common, and that a proportion of patients were classified as having Qi and Yin deficiency. A representative case was treated with modified Shashen Maidong Tang containing *Glehniae Radix* 15 g and *Ophiopogonis Radix* 15 g to nourish Yin and moisten the lung, and *Codonopsis Radix* 20 g and *Astragali Radix* 30 g with *Atractylodis Macrocephalae Rhizoma* and Poria to supplement Qi and strengthen the spleen. Fatigue, dyspnea, dryness of the mouth and throat, and mild cough without sputum were treated, and follow-up indicated reductions in fatigue, dyspnea, sweating, and dryness of the mouth and throat [29]. The combination supplements lung and stomach Yin with *Glehniae Radix* and *Ophiopogonis Radix* while supporting spleen and lung Qi with *Astragali Radix* and *Codonopsis Radix*. It is therefore more appropriate during recovery when healthy Qi has not been restored and both Qi and Yin of the lung and spleen are insufficient.

5.5. Compatibility with *Platycodonis Radix a*nd *Glycyrrhizae Radix et Rhizoma*

Glehniae Radix combined with *Platycodonis Radix* and *Glycyrrhizae Radix et Rhizoma* is used primarily for pharyngeal discomfort, chronic pharyngitis, laryngeal cough, and dryness or itching of the throat caused by dryness injury to the lung and stomach. Zhang Qinxiu used modified Shashen Maidong Tang for chronic pharyngitis, with an emphasis on clearing and nourishing the lung and stomach, generating body fluids, and moistening the throat; this experience may inform syndrome differentiation and treatment of chronic pharyngitis in otolaryngology [30]. *Glehniae Radix* nourishes Yin, generates body fluids, moistens the lung, and benefits the throat; *Platycodonis Radix* disperses lung Qi, restores the voice, and directs medicinals upward; and *Glycyrrhizae Radix et Rhizoma* clears heat, benefits the throat, and harmonizes the formula. *Platycodonis Radix* and *Glycyrrhizae Radix et Rhizoma* form a common clinical pair. A modern review reported throat-soothing, phlegm-resolving, antitussive, expectorant, anti-inflammatory, and immunomodulatory activities relevant to respiratory and pharyngeal conditions [31]. The three-medicinal combination may therefore be considered when Yin and fluid insufficiency is the root and pharyngeal dysfunction is the manifestation. *Arctii Fructus*, *Belamcandae Rhizoma*, and *Isatidis Radix* may be added when heat-toxin is pronounced; *Fritillariae Thunbergii Bulbus* and *Trichosanthis Pericarpium* may be added for sticky sputum that is difficult to expectorate.

5.6. Compatibility with *Polygonati Odorati Rhizoma* and *Lablab Semen Album*

The combination of *Glehniae Radix* with *Polygonati Odorati Rhizoma* and *Lablab Semen Album* derives from the method of clearing and nourishing the lung and stomach in Shashen Maidong Tang. It is suitable for autumn dryness injuring the lung, dryness impediment, and Sjögren's syndrome manifested mainly by dry mouth, dry throat, dry cough with scanty sputum, and dry skin when spleen and stomach function remains adequate. A study of Zhang Minghe's prescribing patterns for Sjögren's syndrome showed that he emphasized both nourishing Yin and moistening dryness and strengthening the spleen and protecting the stomach; *Glehniae Radix* was often combined with *Polygonati Odorati Rhizoma* and *Lablab Semen Album* [32]. *Glehniae Radix* clears and nourishes the lung and stomach, benefits the stomach, and generates body fluids. *Polygonati Odorati Rhizoma* is sweet and moistening and nourishes Yin without being cloying; combining the two strengthens the moistening and fluid-generating effects. *Lablab Semen Album* is sweet and bland, strengthens the spleen, harmonizes the middle jiao, and transforms dampness. It may reduce impairment of the stomach by sweet-cold, softening medicinals so that nourishing Yin remains compatible

with spleen transportation and transformation. Zhang Minghe generally used *Glehniae Radix* at 10–15 g [32]. *Trichosanthis Radix* and *Ophiopogonis Radix* may be added when dryness-heat is pronounced; *Rehmanniae Radix* and *Scrophulariae Radix* may be added for persistent dryness of the mouth and eyes with substantial Yin-fluid depletion; and Spleen-strengthening and Qi-regulating medicinals should be increased for poor appetite and pronounced abdominal distension to avoid relying solely on moistening.

5.7. Compatibility with *Lycii Cortex* and *Moutan Cortex*

Glehniae Radix combined with *Lycii Cortex* and *Moutan Cortex* is commonly used for pulmonary tuberculosis, chronic cough, Yin deficiency with internal heat, tidal fever, and night sweats. In discussing the principal manifestations of pulmonary tuberculosis, Mou Kexiang emphasized the relationship among depletion of lung Yin, internal disturbance by deficiency-heat, and fluid injury from prolonged heat. He used *Glehniae Radix* to nourish Yin and moisten the lung, *Lycii Cortex* to clear deficiency-heat and relieve steaming-bone disorder, and *Moutan Cortex* to cool the blood, clear heat, and vent latent heat, thereby combining Yin nourishment with heat clearing [33]. *Glehniae Radix* replenishes lung and stomach Yin fluids, *Lycii Cortex* clears deficiency-heat and steaming, and *Moutan Cortex* cools the blood without retaining stasis. The combination is appropriate for afternoon tidal fever, heat in the palms and soles, night sweats, dry throat, dry cough with scanty sputum, and a red tongue with a scanty coating. *Glehniae Radix* may be used at 15–30 g and *Lycii Cortex* at approximately 20 g [33]. *Lilii Bulbus* and *Fritillariae Cirrhosae Bulbus* may be added for pronounced cough, *Tritici Fructus Levis* and *Schisandrae Chinensis Fructus* for severe night sweats, and heat-clearing and phlegm-resolving medicinals for substantial phlegm-heat or a yellow, greasy tongue coating. Deficiency-heat should be distinguished from excess heat rather than subsuming both under nourishment of Yin and clearance of deficiency-heat.

5.8. Compatibility with *Fritillariae Cirrhosae Bulbus* and *Lilii Bulbus*

Glehniae Radix combined with *Fritillariae Cirrhosae Bulbus* and *Lilii Bulbus* is suitable for lung Yin depletion and dry phlegm binding internally, as well as for recovery from chronic lung disease when dry cough with scanty sputum, sticky sputum that is difficult to expectorate, hoarseness, and dryness of the throat and mouth are present. In Yang Shaoshan's cases of pulmonary disease, he emphasized concurrent lung Yin injury and lingering phlegm-heat. *Glehniae Radix* was generally used at 12–15 g with *Fritillariae Cirrhosae Bulbus* and *Lilii Bulbus* to moisten the lung, resolve phlegm, nourish Yin, and relieve cough [34]. *Glehniae Radix* nourishes Yin, moistens the lung, benefits the stomach, and generates body fluids, addressing the underlying lung dryness and fluid deficiency. *Fritillariae Cirrhosae Bulbus* moistens the lung, resolves phlegm, clears heat, and dissipates nodules, addressing scanty, sticky sputum that is difficult to expectorate. *Lilii Bulbus* moistens the lung, relieves cough, clears the heart, and calms the spirit, and may also alleviate restlessness and insomnia after prolonged cough has injured Yin. The combination is suited to pulmonary dryness patterns in which Yin injury is the root and dry phlegm is the manifestation. *Platycodonis Radix* and *Glycyrrhizae Radix et Rhizoma* may be added for pharyngeal discomfort; *Pseudostellariae Radix* and *Astragali Radix* for Qi and Yin deficiency; and heat-clearing, phlegm-resolving medicinals for abundant yellow, thick sputum due to phlegm-heat. In the last situation, treatment should not rely solely on nourishing Yin and moistening the lung.

6. Summary

Clinical experience from classical formulas, renowned TCM physicians, dose-effect research experts, and contemporary clinicians suggests that the dosage of *Glehniae Radix* in decoctions should be based on the pharmacopoeial range and increased according to syndrome severity. The Chinese Pharmacopoeia specifies a usual dosage of 5–12 g [1]. The converted dosage of Shashen in classical formulas is generally 7.5–11.25 g, whereas 9–15 g is common in modern practice. The dosage may be increased to 15–30 g under a physician's guidance and on the basis of syndrome differentiation when fluid depletion or dryness-heat is pronounced, or in Qi and Yin deficiency after cancer or chronic disease and wasting-thirst with prominent thirst. Although 30 g has been reported in individual cases, it should not be regarded as a routine dose.

The dosage and combination should be selected according to the type of dryness syndrome, disease, and presenting symptoms. For nourishing Yin and moistening the lung in dry cough, chronic bronchitis, lung cancer, and fluid depletion after radiotherapy or chemotherapy, *Glehniae Radix* is commonly combined with *Ophiopogonis Radix*, *Mori Folium*, *Lilii Bulbus*, *Fritillariae Cirrhosae Bulbus*, *Platycodonis Radix*, and *Anemarrhenae Rhizoma* when patients present with dry cough and scanty sputum, dryness of the throat and mouth, hoarseness, or Yin injury after prolonged cough; decoction doses range from 9 to 30 g, most commonly 10–15 g. For benefiting the stomach and generating body fluids in epigastric pain, chronic gastritis, chronic atrophic gastritis, functional dyspepsia, and stomach Yin injury after febrile disease, it is commonly combined with *Dendrobii Caulis*, *Ophiopogonis Radix*, *Polygonati Odorati Rhizoma*, *Rehmanniae Radix*, *Paeoniae Radix Alba*, and *Glycyrrhizae Radix et Rhizoma* for dull epigastric pain or a gnawing sensation, hunger without desire to eat, dryness of the mouth and throat, dry stools, and a red tongue with scanty fluid; doses range from 10 to 20 g, most commonly 10–15 g. For nourishing Yin and clearing heat in wasting-thirst, Yin deficiency with internal heat, tidal fever and night sweats, and dryness of the mouth and tongue, it is commonly combined with *Trichosanthis Radix*, *Rehmanniae Radix*, *Scrophulariae Radix*, *Lycii Cortex*, and *Moutan Cortex* when thirst, vexing heat in the five centers, or a red tongue with a scanty coating or fluid is prominent; doses range from 15 to 30 g. For supplementing both Qi and Yin in recovery from pulmonary tuberculosis, chronic lung disease, and cancer treatment, it is commonly combined with *Astragali Radix*, *Codonopsis Radix*, *Pseudostellariae Radix*, *Ophiopogonis Radix*, and *Schisandrae Chinensis Fructus* when dyspnea, fatigue, dry cough with scanty sputum, spontaneous sweating or night sweats, dry mouth, and poor appetite are present; doses range from 15 to 30 g. For moistening dryness and benefiting the throat in chronic pharyngitis, laryngeal cough, and hoarseness, it is commonly combined with *Platycodonis Radix*, *Glycyrrhizae Radix et Rhizoma*, *Ophiopogonis Radix*, *Scrophulariae Radix*, and *Sterculiae Lychnophorae Semen* for dry or itchy throat, dry cough with scanty sputum, and impaired phonation; doses range from 10 to 15 g. For nourishing Yin and calming the spirit in insomnia associated with Yin deficiency and internal heat or heart and liver Yin deficiency, it is commonly combined with *Rehmanniae Radix*, *Ophiopogonis Radix*, *Ziziphi Spinosae Semen*, *Polygalae Radix*, and *Salviae Miltiorrhizae Radix et Rhizoma* for restlessness, reduced sleep, dry mouth, and a red tongue with scanty fluid; the dose is approximately 15 g.

The treatment of dryness with *Glehniae Radix* centers on the lung and stomach and primarily aims to nourish Yin and generate body fluids. Combinations should be adjusted according to the principles of moistening without cloying, clearing without excessive coldness, and supplementing without stagnation. Its dose-effect characteristics may be considered at three levels. Small doses provide mild clearing and moistening and are used mainly in early warm-dryness or mild Stomach Yin injury. Moderate doses

emphasize nourishing Yin, benefiting the stomach, moistening the lung, and relieving cough, and constitute the range most commonly used in practice. Larger doses are used more often for substantial fluid depletion, pronounced dryness-heat, or Qi and Yin deficiency caused by chronic consumptive disease, but they should be combined with medicinals that strengthen the spleen, regulate Qi, or protect the stomach to prevent sweet-cold medicinals from impairing the middle jiao. A consensus on Sjögren's syndrome lists Shashen, *Ophiopogonis Radix*, *Polygonati Odorati Rhizoma*, *Rehmanniae Radix*, and *Scrophulariae Radix* among commonly used medicinals for Yin and fluid deficiency, and *Glehniae Radix*, *Ophiopogonis Radix*, *Rehmanniae Radix*, *Anemarrhenae Rhizoma*, and *Moutan Cortex* among commonly used medicinals for Yin deficiency with internal heat [35]. This provides indirect support for the value of coordinating Lung and Stomach treatment with *Glehniae Radix* in dryness syndrome.

Modern pharmacological studies have reported that *Glehniae Radix* exhibits antitussive, expectorant, antiasthmatic, anti-inflammatory, antipyretic, immunomodulatory, antioxidant, antitumor, hypoglycemic, and hepatoprotective activities [2-3]. Its clinical use for dryness syndrome is generally mild, but caution is warranted in patients with spleen deficiency, loose stools, or insufficiency of middle-jiao Yang because the medicine is slightly cold. *Glehniae Radix* should not be used together with *Veratri Radix et Rhizoma* [1]. When it is administered at a high dose or for a prolonged period, the patient's constitution, gastrointestinal tolerance, concomitant medications, and the overall cold-heat balance of the formula should be evaluated.

7. Conclusion

Glehniae Radix is commonly used to treat dryness by coordinating the lung and stomach, clearing and nourishing Yin fluids, and restoring the source of body fluids. Classical formulas generally use 7.5–11.25 g. The experience of renowned TCM physicians and contemporary clinicians indicates that the medicinal can be combined flexibly for lung dryness, stomach dryness, dryness impediment, wasting-thirst syndrome, cancer, and fluid depletion after chronic illness, with an increased dose considered when fluid depletion, Qi and Yin deficiency, or dryness-heat is pronounced. Clinical dosing should be based on the pharmacopoeial range and adjusted according to syndrome severity and the balancing effects of coadministered medicinals. This approach supports the sweet-cold, moistening actions of *Glehniae Radix* in clearing and nourishing the lung and Stomach while reducing the risks of cold medicinals impairing the middle jiao and of using high doses without adequate justification.

Disclosure statement

The author declares no conflict of interest.

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