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Review

Famous traditional Mongolian medicine Xieriga-4 (Turmeric-4) decoction: A review

Dulan, Bagenna, Huan Wang *, Yuanyuan Wu, Ling Ling, Anggelima

NMPA Key Laboratory for Quality Control of Traditional Chinese Medicine (Mongolian Medicine), Key Laboratory of Quality Control of Traditional Chinese Medicine (Mongolian Medicine), State Food and Drug Administration), College of Mongolian Medicine, Inner Mongolia Minzu University, Tongliao 028000, China

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ABSTRACT

Xieriga-4 Decoction, composed of dried rhizomes of *Curcumae longae*, barks of *Phellodendron chinense* or *Phellodendron amurense*, fruits of *Cardenia jasminoides*, and fruits of *Tribulus terrestris*, is a famous prescription of traditional Mongolian medicine for the treatment of urinary system diseases such as frequent urination, urgent urination, urine occlusion, hematuria, bladder irritation and pain. This paper reviewed Xieriga-4 Decoction from the aspects of historical description, prescription principle, chemical components, pharmacology, clinical application and quality control.

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* Corresponding author.
E-mail address: wanghuan8217776@163.com (H. Wang).

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1. Introduction

Mongolian medicine is an empirical medicine gradually accumulated and inherited by Mongolians during their struggle with nature and disease over the long course of history. In the long-term medication practice, a systematic and complete theoretical system has been gradually formed during its development through unique drug resources, processing technique, administration method, continuous absorption, and theoretical development. It is not only a valuable cultural heritage of Mongolia, but also an indispensable part of traditional Chinese medicine. Xieriga-4 Decoction, also known as Mongolian transliteration, from classics *Tongwagajid*, and refers to a prescription composed of four drugs such as turmeric. In the Mongolian Medicine Volume of the *Drug Standard of Ministry of Public Health of the Peoples Republic of China*, it is prepared from four drugs, including rhizomes of *Curcuma longa* L., ripe fruits of *Tribulus terrestris* L., ripe fruits of *Gardenia jasminoides* Ellis, and barks of *Phellodendron chinense* Schneid. or *Phellodendron amurense* Rupr. by extraction, concentration and drying. With functions of dieresis and clearing away damp-heat, the medicine is mainly used to treat urine occlusion, frequent urination, urgent urination, hematuria and bladder irritation and pain. It is the primary choice in treating the heat syndrome of the bladder. Recent studies on the historical origin, prescription analysis, chemical composition, pharmacological action, clinical application, and quality control of Xieriga-4 Decoction are reviewed to provide a theoretical basis for its further clinical application.

Let it be added here that Xieriga-4 (Yongwa-4) has two different prescriptions in Mongolian medicine. In addition to Xieriga-4 from the *Tongwagajid* reviewed in this paper, there is also a prescription contained in the *Encyclopedia of Chinese Medicine – Mongolian Medicine (first) (1986 Edition)* edited by Qingyun Bai and the *Clinical Research of Mongolian Medicine (Mongolian Edition, Volume II)* edited by Professor Surongzab. It has the same name as Xieriga-4 Decoction. The prescription also takes turmeric as the main drug, but the other components are different (croton-dried ripe fruits of *Croton tiglium* L., Rabiagar-sulphide mineral-*Realgar*, grasshopper – the head of *Locusta migratoria* L.) as pills. The efficacy (detoxification, killing viscosity, anti severe diarrhea, and detumescence) and main diseases (diphtheria, anthrax, rabies, carbuncle caused by infectious diseases, etc.) are also different from the decoction in this paper (Bai, 1986; Surongzab, 1999).

2. Historical description

Xieriga-4 decoction was first recorded in the classic *Medical Canon in Four Sections*. It is an authoritative reference book of Tibetan medicine, known as the encyclopedia of Tibetan medicine with the most systematic, complete and fundamental theoretical system of Tibetan medicine. It was completed in the second half of the 8th century CE and written by the famous Tibetan medical expert Yutok Yonden Gonbu, including 156 chapters in four parts. According to the encyclopedia, the medicine is mainly used to treat frequent urination and is composed of *Curcumae Longae Rhizoma* (turmeric), *Berberidis Cortex*, *Phyllanthi Fructus*, *Tribuli Fructus* (Gonbu, 8th century). However, the formula recorded in this book is slightly different from that in Mongolian medicine. *Four Nectar Treatises* (Chapter 30 of Volume II) recorded the treatment of frequent urination with Yongwa-4, Xieriga-4's another name, which was the first time for its name to appear in historical records ('Byor, 18th century). *Obidasen Dalai* (Chapter 90) included this prescription in the treatment of frequent urination: Xieriga-4 Decoction (Yongwa Decoction)-5 qian (a traditional unit of weight in China, 1 qian = 5 g) of *Curcumae Longae Rhizoma* (turmeric), *Phellodendri Chinensis Cortex* and *Gardeniae Fructus*, respectively, 7 qian of *Tribuli Fructus*, make decoction and take several times. The book first recorded the dosage of the ingredients in the prescription (Zhanbula, 1829). *Tongwagajid* (Part 3, Chapter 56) also recorded the use of Yongwa-4 decoction for the treatment of frequent urination, but with different dosage of each component, i.e., 5 qian of *Curcumae Longae Rhizoma* (turmeric), 3 qian of *Phellodendri Chinensis Cortex*, 4 qian of *Gardeniae Fructus*, and 5 qian of *Tribuli Fructus* (Part 5) (Jigmud, 1888). So far, the composition of Xieriga-4 that we have used is recorded in this book, so we generally believe that Xieriga-4 comes from the *Tongwagajid*.

The above prescription enhanced clinical efficacy for a long time, especially in treating urinary system diseases such as frequent urination with damp-heat (gonorrhea) and urinary tract infection, boosting its application since ancient times. It was explored in depth in the 20th century, as it attracted the attention of many scholars, and was included in Jilin Province Drug Standard (*Jilin Provincial Health* Bureau, 1977). Standards for Mongolian Patent Medicine in Inner Mongolia (*Standards for Mongolian Patent Medicine in Inner Mongolia*, 1984). Mongolian Medicine Volume of the Drug Standard of Ministry of Public Health of the Peoples

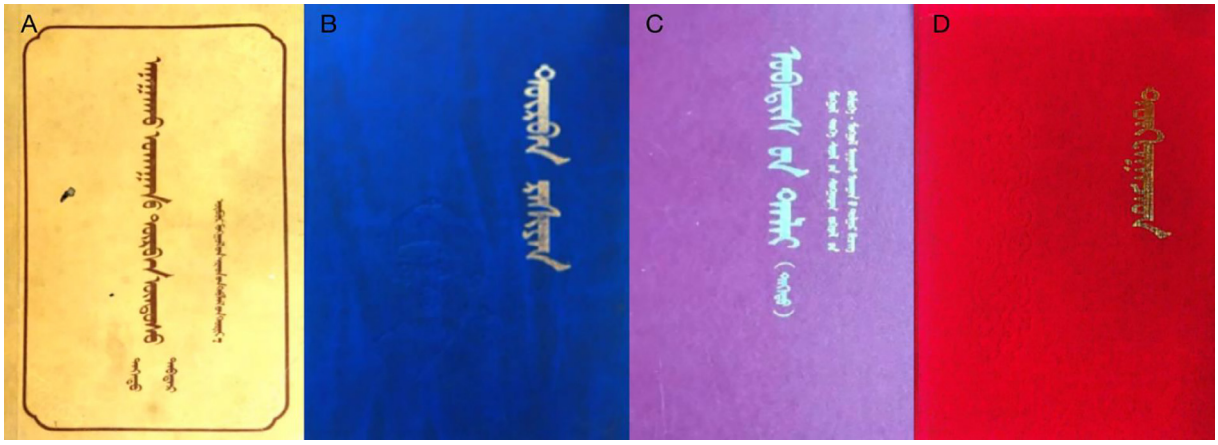

Fig. 1. Historical description books of Xieriga-4. *Medical Canon in Four Sections* (A): It is an authoritative reference book of Tibetan medicine. It was written by the famous Tibetan medical expert Yutok Yonden Gonbu in the second half of the 8th century A. D. *Four Nectar Treatises* (B): It is four medical works by the Mongolian physician Ye Shes Dpal 'Byor in the 18th century during his more than 50 years of medical practice and research career. *Obidasen Dalai* (C): It was written by Zhanbula, a famous Mongolian pharmacist from the 18th to 19th centuries. It is a complete and systematic monograph on Mongolian pharmacy. *Tongwagjid* (D): *Tongwagajid* is the Tibetan name of this book, which is also known as *Traditional Prescription of Mongolian Medicine* and *Joy of the Viewer*. Works on clinical prescriptions of Mongolian medicine. At the beginning of the 20th century, it was written in Tibetan by Jigmud Danjin Zamsu, a pharmacist in East Sunit banner, Xilingol League, Inner Mongolia.

Republic of China (Commission, 1998) becoming a national registered standard preparation (Fig.1).

3. Prescription principles

Urinary tract infection is urinary tract inflammation caused by pathogens invading urinary tract mucosa. In Mongolian medicine, it is called "Xijing" (equivalent to urinary tract infections in modern medicine). It is believed that the main cause of the disease is "Muo Qisu" (You can think of it as blood with disease), excessive "Xierin Halun" (Mongolian medicine has a unique theoretical system, the core of which is the theory of Heyi, Xieri, and Badgan. Being referred to as "three roots or three essence", they run through the whole process of Mongolian medicine pathophysiology, etiology and pathogenesis, syndrome differentiation and treatment, and protecting against evil and keeping healthy. Therefore, they are the essence of Mongolian medicine theory. We can understand that Heyi is the gaseous substance of human body, Xieri is a flammable substance, and Badgan refers to the viscous substance of human body, respectively, and thus Xierin Halun can be seen as the heat of the body.), and local redness by "sticky poison", swelling, and pain, resulting in the functional disorder of "Down cleared-Hey" (There are five types of Heyi, and Down cleared-Heyi is responsible for the body's excretory function) in charge of the urinary tract. The symptoms include urethral tingling, dripping discomfort, frequent urination and other symptoms.

Xieriga-4 is mainly made of *Curcumae Longae Rhizoma* (turmeric, rhizomes of *C. longa*), Mongolian medicine believed it can kill stickiness, prevent rot, detoxify, and these correspond to the anti-inflammatory, detoxification and anti-infection effects of modern medicine. Xieriga-4 is supplemented by *Tribuli Fructus* (ripe fruits of *T. terrestris*) with diuretic and detumescence effects and supplemented by *Phellodendri Chinensis Cortex* (barks of *P. chinense* or *P. amurense*) and *Gardeniae Fructus* (ripe fruits of *G. jasminoides*). The combination of all drugs has the effects of killing viscosity, removing heat and diuresis, which are equivalent to anti-inflammatory, diuretic and analgesic in western medicine. Miraculously, the main component of the prescription removes the main cause of "Muo Qisu", "Xierin Halun", and "Nieyi" (similar to bacteria and viruses in modern medicine) of the disease; the auxiliary drug of *Gardeniae Fructus* heals the disease symptoms. The auxiliary component can improve the prognosis of the disease, removes the root of the disease and achieves the effect of preventing disease recurrence.

As mentioned above, although the composition of the prescription is simplified, the components are perfectly matched, and the therapeutic purpose is accurately achieved for the etiology, symptoms and prognosis of the disease. It is in line with not only the law of drug compatibility in Mongolian medicine theory, but also the precision medical policy. In short, it is a drug worthy of in-depth study.

4. Chemical components

4.1. Curcumae Longae Rhizoma (Turmeric)

Curcumae Longae Rhizoma (turmeric) also known as "Xieriga" in Mongolian, is the main component of Xieriga-4 decoction. It is the rhizomes of *C. longa* mainly containing phenolic pigments (curcumin, demethoxycurcumin, bisdemethoxycurcumin, dihydrocurcumin, etc. (Zhang, Oldenqimuge, Unierjirigala, & Alatenqimuge, 2021), volatile oil including α-turmerone, β-turmerone, α-pinene, β-pinene, thujone, *ar*-turmerone, curdione, limonene, isoborneol, 2-octanol, terpinen-4-ol, etc., carbohydrate such as stigmasterol, β-sitosterol, fatty acids, monoenoic acids, dienoic acid, *p*-coumaroylferuloylmethane, di-*p*-doumaroylmethane, etc., and others (Lu & Mou, 2017; Yan et al., 2021).

Curcumin in turmeric is one of the characteristic active components known to dominate the drug action of this prescription and is categorized as a polyphenolic compound (Moghadamtousi et al., 2014). Curcumin (Fig. 2) has significant antibacterial and antiviral functions. It is also the main pharmacodynamic effect of Xieriga-4 decoction (Fig. 3).

4.2. Tribuli Fructus

Tribuli Fructus also known as ImanJangu in Mongolian, is an adjuvant of Xieriga-4 Decoction, it is the ripe fruits of *T. terrestris*. *Tribuli Fructus* contains steroidal saponins, β-sitosterol, stigmasterol, flavonoids which are more abundant in the leaves and rhizomes of *T. terrestris* than in its fruits, alkaloids such as harman, harmine, harmol, β-carboline, norharmane, *N*-*p*-hydroxyacetophe nyl-3-methoxy-4-hydroxy substituted cinnamamide, *N*-*trans*-feruloyltyramine, *N*-*trans*-*p*-coumaroyltyramine, terrestriamide, tribulusamides A and B, etc., volatile oil, fatty oil, tannin resin, inorganic salt, *T. terrestris* polysaccharides that are less in processed fruits, amino acids, etc (Ren, Zhou, & Wang, 2019).

The steroidal saponins, the main components of *T. terrestris*, are mainly of furostanol and spirostanol types (Fig. 2). These compounds have significant anti-inflammatory and antibacterial effects (Stefanescu, Tero-Vescan, Negroiu, Aurica, & Vari, 2020).

4.3. Gardeniae Fructus

Gardeniae Fructus, also known as Zhurura in Mongolian, is an adjuvant of Xierigar-4 Decoction. It is ripe fruits of *G. jasminoides*. It contains iridoid glycosides, diterpenes, triterpenoids including crocin, crocetin, and its homologues, organic acids including chlorogenic acid, 3,4-di-*O*-caffeoylquinic acids, 3-*O*-caffeoyl-4-*O*-sina poylqouinic acid, etc., pigments such as water-soluble carotenoids, volatile components, saponins, lignans, glycoproteins, etc. (Zhou et al., 2017).

Geniposide is the index and main effective component of *G. jasminoides* (Fig. 2), which is categorized as iridoid glycosides. Moreover, it has strong anti-inflammatory effect (Shan et al., 2017).

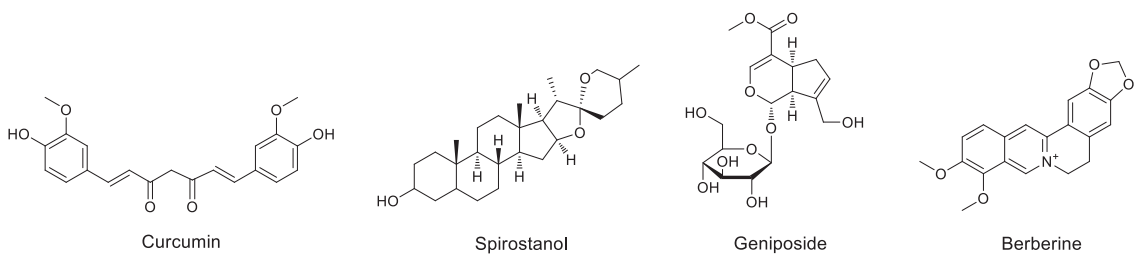

Fig. 2. Chemical structures of main chemical components in each component.

Fig. 3. Pictures of each component in Xieriga-4. *Curcumae Longae Rhizoma* (turmeric) (from China medical information platform, https://www.dayi.org.cn). (A): dried rhizomes of *C. longa*; *Gardeniae Fructus* (B): dried ripe fruit of *G. jasminoides*; *Tribuli Fructus* (C): dried fruit of *T. terrestris*. *Phellodendri Chinensis Cortex* (D): dried barks of *P. chinense* or *P. amurense*.

4.4. Phellodendri Chinensis Cortex

Phellodendri Chinensis Cortex, also known as Xier Modun Dors in Mongolian, is an adjuvant of Xieriga-4 powder, and it is bark of *P. chinense* or *P. amurense.* It contains alkaloids such as berberine, jatrorrhizine, magnoflorine, phellodendrine, candicine, palmatine, and dauricine, flavonoids, terpenoids most of which are triterpenoid compounds including obacunone, obaculactone, obacunonic acid, which are also important components of *P. chinense and P. amurense* sterols such as 7-dehydrostigmasterol, *β*-sitosterol, campesterol, etc., fatty acids, volatile, amides and other compounds (Tian, 2020).

Berberine is one of the characteristic active components known to dominate the drug action of this prescription (Fig. 2). Besides, other alkaloids can effectively inhibit bacteria and inflammation. They all have inhibitory effects on urinary tract infection (Sun, Lenon, & Yang, 2019). Besides, there are limonoid triterpenoids including obacunone, obaculactone, obacunonic acid, sterols including 7-dehydrostigmasterol, *β*-sitosterol, campesterol, etc.

5. Pharmacology

5.1. Diuresis and detumescence

Gao et al. studied the effect of Xieriga-4 on the urine volume and the number of urination (by filter paper weighing method) in rats and mice, and the results showed that the total urine volume at 4 h in the Xieriga group was significantly increased compared with that in the hydrochlorothiazide and Bilinqing capsule groups. The experiment also found that its diuretic effect of Xieriga group is quick (1–2 h) and long-lasting (Gao, Xing, & Dong, 2015). Studies collected the urine by the bell-jar process for testing and measured the swelling degree by carrageenan-induced paw swelling method in experimental rats intervened by Xieriga-4 Decoction powder, tested the urine volume by filter paper weighing method, and measured the swelling degree by xylene-induced ear swelling method in experimental mice. The experimental results showed that the urine volume of rats in the Xieriga-4 Decoction powder group saw a significant increase after 1, 2, 3 and 4 h of administration (most significant at 2–3 h). Xieriga-4 Decoction powder had a similar diuretic effect with the control group (Relinqing granule), with a later effect and longer duration. The results of the ear swelling test showed that the anti-inflammation and detumescence effects of Xieriga-4 Decoction were significantly better than that of the control group. The results of the paw swelling test showed that Xieriga-4 Decoction had a significantly increased detumescence effect 4 h after the intervention (Qing, 2013; Qing & Bagenna, 2009; Shuang, Wei, Qing, & Han, 2015).

5.2. Renal protection

After continuous administration of Xieriga-4 Decoction for 14 days for the gentamicin-induced renal injury model, Li et al. (2019) found that, compared with the model group, Xieriga-4 Decoction could effectively reduce kidney index (KI) and prostate index (PI) levels, serum creatinine (Scr) and blood urea nitrogen (BUN) levels in the serum, and urinary protein (UP), *N*-acetyl-beta-*D*-glucoaminidase (NAG), and kidney injury molecule-1 (KIM-1) expression levels in the urine of rats. Pathological sections showed that glomerular mesangial cell proliferation improved significantly and tubular epithelial cell shedding significantly inhibited in the Xieriga-4 Decoction group.

Researchers applied Xieriga-4 Decoction of four drugs combined with Sugmel-10 and Narenmandula-11 to diagnose and treat diabetic nephropathy (DN) based on syndrome differentiation. They found that the combined administration of the three prescriptions for one day could effectively inhibit renal injury. The study also revealed that its renal protective mechanism might be associated with pathways such as Matrix metalloproteinase-2 (MMP-2) and Transforming growth factor-β (TGF-β) (Wang, Li, Liu, Wang, & Wei, 2015).

5.3. Anti-inflammation and labor pain

Zhang (2019) found that the levels of tumor necrosis factor-α (TNF-α), prostate specific antigen (PSA), interleukin-4 (IL-4), and prostaglandin E2 (PGE2) factors in the serum of experimental rats were significantly reduced in the Xieriga-4 group compared with the model group, and HE staining of prostate tissues revealed that the number of inflammatory cells was significantly decreased and inflammatory characteristics alleviated considerably in the Xieriga-4 group compared with the model group.

Qu et al. found that Xieriga granule effectively inhibited not only acetic acid-induced abdominal and hot plate irritation and pain, but also xylene-induced inflammation by writhing and hot plate test and xylene-induced inflammation test in mice (Qu, Altanqimeg, & Odunqimeg, 2018).

5.4. Bacteriostasis

Qu also found that Xieriga-4 could significantly inhibit *Staphylococcus aureus* and *Escherichia coli in vitro*, but with no significant protective effect on intraperitoneal inoculation of *E. coli* in mice through bacteriostasis test *in vivo* and *in vitro* in mice (Qu et al., 2018).

Durina and Wurina (2013) performed bacterial and fungal inhibition experiments on Xieriga lotion by the test tube and cup-plate methods. They found that the lotion could effectively inhibit such fungi as *Microsporum lauosum*, *M. gypseum*, *M. canis*, *Trichophyton rubrum*, *Candida albicans*, and *Malassezia*. The results of inhibition of bacteria showed that for the inhibition of G- bacteria: the lotion could effectively inhibit *Pseudomonas aeruginosa* (with a stronger effect on gentamicin); it was ineffective against *Bacterium vulgare* and resistant *E. coli* (20% ethanol applied in the control group also had no inhibitory effect on the above two strains). For the inhibi-

tion of G + bacteria: the lotion could significantly inhibit *Staphylococcus aureus*, *Bacillus anthracis*, *Staphylococcus albus*, etc. (with a stronger effect on penicillin, while 20% ethanol applied in the control group had no inhibitory effect on the above strains). Wurina et al. studied Xieriga lotion by conducting *in vitro* fungal inhibition tests in culture media and found that the lotion could effectively inhibit fungi: *M. gypseum* (with an effective rate of 100%), *M. lauosum* (94%), *Candida albicans* (100%), and *Trichophyton rubrum* (93%) (Wurina & Gao, 2013). In addition, an article on pharmacology of various component networks of Xieriga-4 reported 12 targets such as estrogen receptor, Bcl-2, COX-2, S5AR, ALR2, AR, PAP, IL-6, IL-8, aromatase, etc. associated with prostate hyperplasia and prostate cancer (Bai, Li, Dong, & Zhang, 2018). They also found that Xieriga-4 may regulate the expression of prostate CA-related target genes through Wnt/β-catenin and AR signaling pathways.

It is precisely because Xieriga-4 Decoction has the above-mentioned pharmacological effects corresponding to nephritis, cystitis, prostatic hyperplasia, urinary tract infection and other urinary infectious disease, for example, diuresis and detumescence, anti-inflammation and labor pain, bacteriostasis, renal protection, as well as its advantages of high safety and small toxic and side effects, which shows an excellent therapeutic effect in urinary diseases, especially infectious urinary diseases.

6. Clinical applications

6.1. Urinary infectious diseases

Xieriga-4 Decoction is widely adopted in Mongolian medicine clinically for the treatment of urinary infectious diseases such as nephritis, cystitis, benign prostatic hyperplasia, and urinary tract infection. Yan & Zhang, 2020 divided 75 patients with benign prostatic hyperplasia into two groups. The Mongolian medicine group was given Xieriga-4 Decoction combined with Sugmel-10, while the Western medicine group was given finasteride tablets and tamsulosin hydrochloride sustained-release capsules (Harnal). Both groups were treated for three months. The symptoms, signs, and ultrasonic inspections were observed before and after treatment to measure prostate parameters, and the results showed that the Mongolian medicine group had a significant effect, with high safety, as well as less toxic and side effects. Shi & Lu, 2015 applied an Xieriga capsule of four drugs combined with levofloxacin to treat 30 lower urinary tract infection patients. After 7 to 10 d, it was found that the total effective rate in this group hit 93.3% (73.3% in the Western medicine alone group), demonstrating the ideal clinical efficacy of Xieriga capsule of four drugs combined with Western medicine in the treatment of lower urinary tract infection. This regimen had witnessed a significantly improved efficacy compared with levofloxacin alone, with no significant adverse reactions. A clinical observation observed 60 elderly female patients with urinary tract infection, with Xieriga decoction of four drugs orally administrated in the morning as the main drug and Xieriga-4 lotion sitz bath before bedtime for 4–6 weeks, and the indicators such as symptoms, urinalysis showed that the total effective rate for 60 patients with urinary tract infection hit 98.3%. With complete eradication effect, this treatment regimen was also found to have better long-term efficacy and low recurrence rate at the follow-up visit after twelve months (Xiu, Qi, & Zhang, 2018). Another clinical observation randomly divided 72 patients with urinary tract infection into the Xieriga-4 capsule combined with gatifloxacin group and the gatifloxacin alone group. After treatment for 7–10 d, the total effective rate hit 91.9% and 74.2%, respectively, and the negative conversion ratio of bacteria hit 91.4% and 78.1%, respectively, both with significant differences. The incidence rate of adverse reactions was similar between the two groups, demonstrating the better clinical efficacy of Xieriga-4 capsule combined with Western medicine in the treatment of urinary tract infection, with no significant adverse reactions (Wang & Wang, 2014). Moreover, in recent years, many scholars have also obtained better efficacy in treating other diseases using this prescription.

6.2. Diabetes treatment

Many studies and clinical applications have demonstrated that Xieriga decoction of four drugs has a hypoglycemic effect. For example, studies demonstrated that Xieriga decoction exhibited significant hypoglycemic and anti-inflammatory effects, with less probability of complications and low price, etc., and was expected to serve as an ideal Mongolian medicine for the intervention of diabetic nephropathy. This research group randomly divided 80 DN patients into the Western medicine group (repaglinide tablets combined with metformin hydrochloride sustained-release tablets) and Mongolian and Western medicine treatment group (Western medicine + Sali-Gardi + Xieriga decoction of four drugs). After treatment for eight weeks, the clinical symptoms and 24 h urine microalbumin changes before and after treatment in each group were observed. The results showed that the total effective rate in the Mongolian medicine combined with Western medicine group hit 90%, higher than 77.5% in the Western medicine group; the 24 h urine microalbumin excretion rate in the former group was significantly lower than that in the latter. Compared with the Western medicine group, symptoms such as turbid urine, frequent urination with profuse urine, soreness and weakness of waist and knees, and tiredness and weakness were significantly improved in the Mongolian medicine and Western medicine group, with no significant difference in the effect of improving dry mouth and desire to drink, and feverishness in palms and soles between the groups. There was no adverse reaction in all patients before and after treatment including examinations of liver and kidney function, blood, urine and stool routine, and ECG (Fang & Liu, 2020; Liu, Zhang, & Wu, 2013). Shi et al. applied Xieriga decoction of four drugs and Sali Garidi combined with Western medicine (repaglinide tablets and metformin hydrochloride sustained-release tablets) to treat 50 patients with early type 2 DN based on syndrome differentiation. The results showed that the total effective rate of urine microalbumin excretion rate, symptoms and signs, UAER, and recovery of renal function hit 96% in the Mongolian medicine and Western medicine treatment group, and 82% in the 50 patients in the Western medicine alone group (repaglinide tablets and metformin hydrochloride sustained-release tablets), demonstrating the effectiveness and safety of the combination in treating early DN (Shi, Zhang, & Li, 2020). Bao (2019) found through clinical studies that after two weeks of treatment with Sali-Garidi combined with Xieriga decoction of four drugs in 50 DN patients, the 24 h urinary protein and urinary albumin excretion rate of patients were significantly reduced in the treatment group, with no significant changes in liver and kidney function, blood routine and other examinations of all patients before and after treatment. It demonstrated that Xieriga-4 Decoction combined with Sali Gardi was safe and effective in treating DN. Zhu (2021) randomly divided 120 DN patients into two groups. The Western medicine group was given conventional drugs for diabetes (insulin for patients with type 1 diabetes and repaglinide tablets and metformin hydrochloride sustained-release tablets for patients with type 2 diabetes). The Xieriga-4 group was given Xieriga-4 Decoction combined with the above hypoglycemic drug regimen. After 8 weeks of treatment, it was found that the proportion of patients with improved symptoms such as soreness and weakness of waist and knees, turbid urine, frequent urination with profuse urine in the Xieriga-4 group was significantly higher than

that in the Western medicine group; the symptoms including tiredness, feverishness in palms and soles, and dry mouth and desire to drink were also relieved to vary degrees in each group. Fasting blood glucose, postprandial blood glucose and glycosylated hemoglobin levels, Scr, BUN, and 24 h urine microalbumin excretion rate were significantly decreased in each group, and the above blood glucose levels and kidney function levels were significantly lower in the Xieriga-4 group compared with the Western medicine group. The Scr level was significantly increased in each group and was significantly higher in the Xieriga-4 group compared with the Western medicine alone group.

6.3. Acne

A study applied Xieriga capsule of four drugs to treat 67 patients with acne with the accumulation of damp-heat in the body, while another 49 patients were being treated with minocycline (minocycline) as the control group. After six weeks, the total effective rate in the Xieriga capsule of four drugs group hit 85.1% (65.3% in the control group). Through observation, it was found that Xieriga capsule of four drugs could effectively prevent pigmentation and scars and reduce the pigmentation caused by acne, with high safety (Wu, 2009).

7. Quality control

Li et al. determined the contents of baicalin, bisdemethoxycurcumin, demethoxycurcumin, and curcumin in Xieriga decoction of four drugs by high-performance liquid chromatography. The results showed a good linear relationship (r > 0.9998) between the concentration of the determined components and their peak areas within the linear range. The average recoveries were 97.2%, 97.1%, 96.4%, and 96.8%, the RSDs of 1.1%, 1.4%, 0.86%, and 1.0%, and the average contents were 0.0080%, 0.0377%, 0.0292%, and 0.0631%, respectively (Li, Bai, Zhao, & Dong, 2018).

Li et al. determined the contents of jasminoidin, curcumin, and berberine hydrochloride in Xieriga decoction of four drugs by HPLC. The results showed that the optimum conditions for effective separation, good reproducibility, linearity and precision as well as rapid, simple and accurate determination were Elite C_{18} (4.6 mm × 250 mm, 5 μm) chromatographic column, acetonitrile (A)-0.4% potassium dihydrogen phosphate aqueous solution (B) as the mobile phase, a chromatographic system established at 30 °C, detection wavelength of 238 nm for geniposide and 346 nm for curcumin and berberine hydrochloride, as well as the flow rate of 1.0 mL/min (Li, Yang, & Dong, 2014). Bagenna et al. performed fluorescence scanning by TLC with *n*-butanol: glacial acetic acid: water (7:1:2) and an excitation wavelength of 365 nm, and detected *Curcumae Longae Rhizoma* (turmeric), *Phellodendri Chinensis Cortex*, and *Gardeniae Fructus*, respectively in Xieriga Decoction of four drugs. The results showed a linear relationship between berberine hydrochloride and its corresponding integrated value of fluorescence intensity within the range of 0.0196–0.1568 μg, with r = 0.998; an average recovery of 100.14%, and RSD of 1.87% (n = 6) (Bagenna, Qiqigma, & Li, 2007).

8. Conclusion and prospects

To sum up, the prescription is cool in nature. With killing stickiness, antiseptic and detoxifying, *Curcumae Longae Rhizoma* (turmeric) as the main drug, supplemented by *Tribuli Fructus* for diuretic and detumescence, *Gardeniae Fructus* for blood heat eliminating and *Phellodendri Chinensis Cortex* for heat clearing, the organic combination has become a prescription with killing stickiness, heat clearing and diuretic effects. It is mainly used for the treatment of frequent urination, urgent urination, urine occlusion, hematuria, and bladder irritation and pain.

Xieriga decoction of four drugs has served as a special prescription for urinary system diseases for a long time and has excellent clinical feedback. With the great progress in modern scientific research in recent years, many scientific and clinical studies have demonstrated that Xieriga-4 Decoction enjoys significant pharmacological actions such as diuresis, inflammation elimination, bacteriostasis, pain relief, and immune regulation, with higher safety. Moreover, the components of this prescription are simple and easy to obtain, but the components are perfectly matched, and the therapeutic purpose is accurately achieved for the etiology, symptoms and prognosis of the disease. It is in line with not only the law of drug compatibility in Mongolian medicine theory, but also the precision medical policy. At present, in addition to the original dosage form of decoction, there are capsule, tablet, granule, spray, lotion, and other improved dosage forms. It is a group of safe, effective preparations with Mongolian characteristics.

However, the basic research on this preparation is not deep enough, which is a real problem faced by many excellent Mongolian medicines. Efforts need to be made to carry out more in-depth pharmacological analysis on the basis of existing research, or even to analyze the quality of its chemical components using advanced techniques such as molecular biology and cell biology, to elucidate the material basis of its medicinal effects and to clarify its mechanism of action and targets. By doing so, a stable and reliable specification can be established to ensure the safety of clinical application, thus promoting the overall development of Xieriga-4 Decoction and its wider clinical application.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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