# Postprint of an Ethnobotanical Study on Prinsepia utilis and Its Skin Care-Related Traditional Knowledge

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## Abstract

Prinsepia utilis is a perennial deciduous shrub used as both food and medicine in the multi-ethnic region of northwestern Yunnan, widely utilized by local communities in traditional culture, medicine, and food. With the development of modern society, Prinsepia utilis and its associated traditional knowledge are facing the danger of disappearance. To explore the conservation and inheritance of Prinsepia utilis resources and related traditional knowledge in this region, this study, based on ethnobotanical field investigations, employed methods of natural medicinal chemistry and pharmacological activity testing to conduct preliminary research on the material basis of its main traditional efficacy and its skincare activity. The results showed that: (1) In the multi-ethnic inhabited areas of northwestern Yunnan, Prinsepia utilis is widely used for various traditional purposes such as fence protection or windbreak and soil consolidation, treatment of skin trauma, and food; (2) Ten monomeric compounds with skincare activity, including gallic acid and quercetin, were detected in extracts from different parts of Prinsepia utilis; (3) The total flavonoid content in the extract of young leaves of Prinsepia utilis is higher than that in its fermented product and fruit extract; (4) The Prinsepia utilis fruit oil, which has the highest frequency of traditional use, exhibits good DPPH free radical scavenging activity, with antioxidant activity varying among different origins and processing techniques. These research findings preliminarily verify the correlation between the material basis of the traditional skincare efficacy of Prinsepia utilis and its related activities, providing a preliminary applied research foundation for the conservation, inheritance, and in-depth development of Prinsepia utilis resources and related traditional knowledge.

# Full Text

## Preamble

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**Title:** Ethnobotanical Study on *Prinsepia utilis* and Related Traditional Knowledge with Skin Care

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## Abstract

*Prinsepia utilis* is a perennial deciduous shrub used as both food and medicine in the multi-ethnic communities of northwestern Yunnan, where it is widely applied in traditional culture, medicine, and cuisine. With modern societal development, *P. utilis* and its associated traditional knowledge face the risk of disappearance. To explore the conservation and inheritance of *P. utilis* resources and related traditional knowledge in this region, this study conducted preliminary investigations into the material basis of its main traditional efficacy and skin care activities using methods from natural medicinal chemistry and pharmacological testing based on ethnobotanical field research. The results indicate: (1) In the multi-ethnic communities of northwestern Yunnan, *P. utilis* is extensively used for fencing and windbreaks, soil fixation, treatment of skin trauma, food, and other traditional applications; (2) Ten individual compounds with skin care activity, including gallic acid and quercetin, were detected in extracts from different plant parts; (3) The total flavonoid content of tender leaf extracts was higher than that of both fermented products and fruit extracts; (4) *P. utilis* fruit oil, the most frequently utilized traditional product, demonstrated excellent DPPH free radical scavenging activity, with variations in antioxidant activity observed among different producing areas and processing methods. These findings preliminarily validate the correlation between the material basis and related activities of *P. utilis*' s traditional skin care efficacy, providing foundational applied research for the conservation, inheritance, and further development of *P. utilis* resources and associated traditional knowledge.

**Keywords:** *Prinsepia utilis*; traditional skin care knowledge; efficacy verification; ethnobotanical study

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## Introduction

*Prinsepia utilis* Royle is a perennial deciduous shrub belonging to the family Rosaceae and genus *Prinsepia*. Various ethnic groups have named it according to its edible and medicinal properties, including "qingciguo," "qingcijian," "jidan guo," and "dayou guo" (China Pharmaceutical University, 1996). The plant reaches 1–2 m in height with multiple clustered stems, bearing green hard thorns 0.8–2.0 cm long, and exhibits the biological characteristic of winter flowering and spring fruiting (He et al., 2020). It is distributed across the Himalayan region, including China, India, Nepal, Pakistan, and Bhutan. In China, it primarily grows in alpine mountainous areas of southwestern China (1,400–3,100 m elevation), mainly in the western Yunnan-Guizhou Plateau and Tibet (Ma et al., 2019; National Compilation of Chinese Herbal Medicine, 1975). Within Yunnan Province, it is found in northwestern, central, and southeastern regions (Yunnan Provincial Medicinal Materials Company, 1993). The core distribution areas in Yunnan include Lijiang City, Dali Bai Autonomous Prefecture, and Diqing Tibetan Autonomous Prefecture in northwestern Yunnan, where the optimal growth altitude is 2,100–2,700 m. Typical habitats include slopes, valleys, stream banks, wastelands, and shrublands.

Traditional knowledge of *P. utilis* was first recorded in *Materia Medica from Yunnan*: "Qingcijian, cold in nature and bitter in taste, attacks all sores, carbuncles, and toxic swellings, brings pus to a head or eliminates abscesses without pus, and disperses tubercles; chew finely and take with wine" (Lan, 1975). Additionally, the Naxi text *Yulong Materia Medica* records: "Tender stems and leaves of *P. utilis* treat high fever and convulsions in children, lung heat cough, pneumonia, lymphatic tuberculosis, sore throat, wind-fire toothache, knife wounds, bone fractures, remove nebulae and brighten eyes, and treat toxic sores; *P. utilis* fruit oil treats persistent cough" (He, 2018). The plant is known as "Anasi" by the Naxi, "Zoudaqijian" by the Bai, "Nizhengniu" by the Yi, "Qingnamanan" by the Mosuo branch of the Naxi, "Kaobozha" by the Miao, and "Cina" by the Pumi, with a history of over 500 years as a food-medicine plant in northwestern Yunnan (He, 2018). In this ethnic region, it is used for carbuncles, furuncles, and swellings (Yunnan Institute of Materia Medica and Yunnan Ethnic Medicine Engineering Technology Research Center, 2009), trauma healing, frostbite, dry itch, and infant eczema. According to *Xinhua Compendium of Materia Medica*: "The stems and leaves of *P. utilis* treat carbuncles, toxic sores, wind-fire toothache, gunshot wounds, bone fractures, and snakebites" (Jiangsu Institute of Botany, 1990).

Modern research indicates that *P. utilis* stems contain (-)-epicatechin, broussonin F, quercetin, isorhamnetin, kaempferol, $\beta$-sitosterol-$\beta$-glucoside, and prinsepiol (Kilidhar et al., 1982; Guan, 2013). The seeds contain approximately 35% oil, rich in flavonoids, polysaccharides, fatty acids, alkaloids, and other active components (He et al., 2016). The total flavonoid content in *P. utilis* fruit crude extracts reaches 7.20%–7.30%, while in oil meal it is 0.37%–0.38% (Zhan et al., 2010). The extraction rates of flavonoids from *P. utilis* fruit using water extraction and microbial extraction are 0.37% and 0.88%, respectively (An et al., 2017). The total flavonoid content in seeds is (480.91 ± 3.86) mg • (100 g)$^{-1}$, while in meal it is (372.82 ± 1.17) mg/100g (Gao et al., 2019). Twenty-four flavonoid compounds have been isolated from *P. utilis* fruit, including quercetin, eriodictyol, kaempferol, (+)-catechin (Yang et al., 2015), quercetin-3-O-$\beta$-D-rutinoside, quercetin-3-O-$\beta$-D-glucoside, protocatechuic acid, apigenin, kaempferol-7-glucoside, rutin, narcissin (Gao et al., 2018), p-coumaric acid, kaempferol-3-O-rutinoside-7-O-glucoside, isoschaftoside, quercetin-3-O-(6 -O-acetyl)-$\beta$-D-glucopyranoside, isorhamnetin-3-O-rutinoside, kaempferol-3-O-rutinoside, isorhamnetin-3-O-glucoside, cyanidin, cyanidin-3-O-rutinoside, peonidin, peonidin-5-O-glucoside, delphinidin 3-O-rutinoside, and petunidin-3-O-glucoside (Liu et al., 2021). *P. utilis* contains numerous flavonoids, with significant content variations among different plant parts and processing methods. Flavonoids are commonly reported to have hypotensive, lipid-lowering, and anti-inflammatory effects, representing common compounds among polyphenols. The pharmacological activities of some of these flavonoids isolated from *P. utilis* fruit and stems are summarized in Table 1.

Research on the antioxidant effects of *P. utilis* fruit oil demonstrates that certain dosage levels can increase serum SOD levels in hyperlipidemic rats, exhibiting good antioxidant activity (Zhang and Lin, 2005). Studies using water extraction and microbial extraction to examine DPPH free radical scavenging by *P. utilis* fruit crude extracts show that microbial extracts exhibit stronger DPPH scavenging than water extracts at the same dilution, indicating the feasibility and superiority of microbial extraction for plant active substances (An et al., 2017). Antioxidant activity studies on *P. utilis* seeds, meal, and fermented seeds reveal that both seeds and meal possess strong free radical scavenging abilities, with effects showing a dose-response relationship with phenolic content (Gao et al., 2018). Research on antioxidant and anti-inflammatory effects of *P. utilis* leaf extracts demonstrates anti-inflammatory and antioxidant activities in BPH rats (Peng et al., 2021). Additionally, *P. utilis* exhibits immunomodulatory, antibacterial and anti-inflammatory, hypoglycemic and hypolipidemic, anti-inflammatory, and antioxidant pharmacological effects (An et al., 2017). Skin cosmetic activity screening studies show that ethanol extracts from *P. utilis* roots, stems, leaves, flowers, seeds, stem bark, fruit pulp, meal, and fruit oil maintain cell viability above 80% at 100 g • mL$^{-1}$ concentration in HDFa cytotoxicity assays. Notably, seed, flower, and meal extracts demonstrate high safety and certain cell regeneration-promoting functions, with good safety profiles ($IC_{50}$ = 0.242 g • mL$^{-1}$). DPPH antioxidant activity assays indicate that fruit pulp extracts exhibit good antioxidant activity (Yang, 2015).

In northwestern Yunnan' s ethnic minority regions, *P. utilis* has been widely used historically as a food-medicine plant. However, with changes in local production and lifestyle, reduced biodiversity accompanied by the loss of traditional knowledge threatens the accumulated effective methods of *P. utilis* application. While progress has been made in understanding its chemical composition and cultivation techniques, the material basis and activities related to its primary traditional skin care efficacy remain unverified and unsystematically studied. To confirm whether the traditional knowledge of *P. utilis* application in this region is genuinely effective and whether its traditional skin care efficacy can be experimentally supported, this study investigated *P. utilis* in northwestern Yunnan' s ethnic minority regions. First, ethnobotanical methods were employed for field surveys to collect *P. utilis*-related traditional knowledge and document its traditional skin care efficacy. Based on ethnobotanical research, natural medicinal chemistry and pharmacological approaches were used to explore the traditional skin care efficacy and its material basis. The research addressed: (1) What traditional knowledge exists regarding *P. utilis* utilization in northwestern Yunnan? (2) Which activity indicators align with skin care-related traditional efficacy, and what material basis supports these effects? (3) Can preliminary applied basic research be provided for potential skin care applications?

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## 1.1 Ethnobotanical Field Investigation

**Participatory Observation:** During research in Naxi communities, participatory observation methods were used to document traditional processing methods and cultural uses of *P. utilis*.

**Key Informant Interviews:** Using ethnobotanical field survey methods, 840 informants across 14 regions were interviewed, including Ludian Village and Xinzhu Village in Ludian Township, Heyuan Administrative Village in Jiuhe Township, Lunan Village in Longpan Township, Jinshan Township, Tacheng Town in Weixi County, Yongning Town in Ninglang County, Shigu Town, Mingyin Township, Dadong Township, Baisha Town, Lashi Town, Longshan Township, Tai' an Township, and Jianchuan County market (Figure 1 [Figure 1: see original paper]). Informants' education levels were: 54% primary school graduates, 31% junior high school graduates, and 15% senior high school graduates. Interviewing numerous informants across ethnic communities provided authentic reflection of actual *P. utilis* application. Preliminary surveys revealed that *P. utilis* fruit oil and tender shoots are commonly consumed as edible oil and wild vegetables across ethnic communities. Traditional doctors over 50 years old use *P. utilis* fruit oil to treat various skin diseases, with 60–70-year-old practitioners treating hundreds of patients annually. Therefore, this study focused on key informant interviews, comprising 144 individuals including 72 traditional doctors, 42 traditional medicinal plant cultivators, and 30 community-recognized elders with rich life experience. The remainder were local ethnic minority villagers who had consumed *P. utilis* fruit oil and shoots.

With assistance from community elders and village heads, interview content included plant names, usage methods, applications, and used parts.

**Ethnobotanical Inventory:** Inventory contents included: scientific species name, using ethnic group, local name, used part, efficacy and usage method, and voucher specimen number. Voucher specimens (No. 1315305) are deposited at the Herbarium of Kunming Institute of Botany, Chinese Academy of Sciences (KUN).

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### 1.2.1 Materials, Instruments, and Reagents

**Materials:** *P. utilis* fruit oil (Sample 1) was collected in July 2021 from Yongsheng County, Lijiang City; *P. utilis* fruit, tender leaves, fermented tender leaves, and fruit oil (Sample 2) were collected in July 2021 from Yulong County, Lijiang City, Yunnan Province; fruit oil (Sample 3) was purchased in December 2021 from Weixi County, Diqing Tibetan Autonomous Prefecture. *P. utilis* specimens were collected from surveyed communities and identified by Senior Engineer YANG Lixin at Kunming Institute of Botany, Chinese Academy of Sciences as *Prinsepia utilis* Royle (Rosaceae).

**Reagents:** Rutin standard and DPPH were purchased from Sigma Company. Ethyl acetate, methanol, ethanol, acetonitrile, $NaNO_2$, $AlCl_3$, and NaOH were all analytical grade.

**Instruments:** Rotary evaporator (Shanghai Ailang Instrument Co., Ltd.), KQ-500E ultrasonic cleaner (Kunshan Ultrasonic Instrument), UV-5500PC spectrophotometer (Shanghai Yuanxi Instrument Co., Ltd.), and 1260 Infinity HPLC (Agilent Technologies).

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### 1.2.2 Extraction and Separation

Dried tender leaf samples, *P. utilis* fruit, and fermented tender leaves were crushed and sieved. A 100 g sample was weighed and extracted with excess 70% ethanol by ultrasonication at 30 °C for 1 hour, repeated three times. The extract was filtered, rotary evaporated, and prepared as a 1 $g \cdot mL^{-1}$ concentrate.

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### 1.2.3 Determination of Total Flavonoid Content

**Standard Curve:** Using rutin as the standard, 10 mg of rutin standard was precisely measured and diluted to 50 mL to prepare a 200 $g \cdot mL^{-1}$ rutin standard solution. Aliquots of 0, 0.2, 0.4, 0.8, 1.2, 1.6, and 2 mL of standard rutin solution were placed in test tubes, followed by addition of 0.3 mL 5% $NaNO_2$, mixing, and standing for 6 minutes. Then 0.3 mL 10% $AlCl_3$ was added, mixed, and stood for 6 minutes. Next, 4 mL 4% NaOH was added, diluted to 10 mL with 60% ethanol, mixed, and stood for 12 minutes. Absorbance was measured at 510 nm. The standard curve equation was: y = 0.0087x - 0.0021 (R = 0.9997).

**Sample Determination:** One milliliter of sample solution was placed in a test tube, and the same procedure as above was followed. Total flavonoid concentration in the sample solution was calculated based on the rutin standard curve linear equation.

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### 1.2.4 Liquid Chromatography Analysis

**Chromatographic Conditions:** Column: 20 RBA×SB-C18 $4.6 \times 250 mm$; Mobile phase A: water, B: acetonitrile, with gradient elution (Table 2); Flow rate: $1 mL \cdot min^{-1}$; Column temperature: 30 °C.

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### 1.2.5 DPPH Free Radical Scavenging Capacity

*P. utilis* extracts were dissolved in methanol and diluted to appropriate concentrations; fruit oil was dissolved in ethyl acetate and diluted. One milliliter of different sample concentrations was placed in test tubes, mixed with 1 mL $2\times10^{-4}$ mol $\cdot$ $L^{-1}$ DPPH solution, reacted in the dark for 30 minutes, and absorbance was measured at 517 nm. Blank and sample control groups were established. DPPH scavenging rate was calculated using the formula:

DPPH scavenging rate (%) = $[A_{blank} - (A_{sample} - A_{control})] / A_{blank} \times 100\%$

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### 2.1 Traditional Food, Medicine, and Skin Care Knowledge of *P. utilis*

*P. utilis* is widespread across fields and mountains in northwestern Yunnan. Through ethnobotanical field surveys in five ethnic communities (primarily Naxi), 24 *P. utilis* samples were collected under the guidance of key informant community traditional doctors. All 24 specimens were identified by Senior Engineer YANG Lixin at Kunming Institute of Botany as *Prinsepia utilis* Royle. Digital images were taken to document resource morphology and habitat information (Figure 2 [Figure 2: see original paper]).

The ethnobotanical survey documented traditional knowledge of *P. utilis* resource utilization by ethnic minorities in northwestern Yunnan, including using ethnic groups, local names, used parts, and traditional disease applications (Table 3 ).

Northwestern Yunnan is a typical multi-ethnic region where five ethnic minorities, primarily Naxi, have accumulated rich knowledge of medicinal and edible plants through unique understanding of plant utilization. *P. utilis* is used by these five ethnic minorities for food, medicine, and skin care applications, with used parts including leaves, fruit, and roots (Table 3). The plant flowers profusely in winter, though fruit set is less abundant than flowering (Figure 2: B). Immature fruit is green, turning dark purple-red when mature with a white powdery coating (Figure 2: C).

Locals clean and sun-dry excavated roots for decoction. Consuming tender shoots is a major wild woody vegetable; new branches and leaves emerge in summer, and locals harvest tender shoots as fresh vegetables (Figure 2: A), which are sold in local markets. Tender shoots can be eaten cold, in soup, or stir-fried with or without meat. For year-round consumption, shoots are also pickled for long-term preservation, providing good freshness retention and heat-clearing effects (Figure 2: D). Ethnic minorities harvest fruit in spring, wash the skin, sun-dry, and press for edible oil (Figure 2: E). The meal remaining after oil pressing is commonly used as poultry feed, and the plant has been developed by local enterprises as a plateau characteristic edible oil. However, *P. utilis* is also cultivated extensively, and its axillary thorns make harvesting difficult, requiring substantial labor for wild collection. The plant has high medicinal value, with traditional doctors primarily using roots and leaves for various disease treatments.

The primary skin care application uses the fruit, which has value across food, medicine, and skin care. Local traditional doctors use fruit for disease treatment, and community members have extensive traditional usage experience. Except for the Miao, fruit usage cases exist among four other ethnic groups in northwestern Yunnan. Fruit is primarily used for pressing *P. utilis* fruit oil, which has high usage frequency in ethnic communities. Ethnic minorities in northwestern Yunnan live at high altitudes (2,400–2,600 m) with strong UV radiation and light intensity; the cold, dry climate causes skin problems including sunburn, cracking, sun spots, and rashes. Research shows polymorphous light eruption prevalence in Yunnan is higher than chronic actinic dermatitis, particularly among middle-aged women, with higher rates at high altitudes (Deng et al., 2008). *P. utilis* fruit oil is essential for infant eczema; Naxi people apply freshly pressed oil to newborn skin to prevent eczema. Locals apply fruit oil to exposed skin to prevent chapping and sunburn, and in winter to prevent frostbite and moisturize skin. Yi women, who traditionally wear their hair long, straight, and black, use *P. utilis* fruit oil as hair care oil to maintain softness and luster. As fruit oil value continues to be discovered, numerous primary processing workshops have emerged locally.

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## 2.2 Functional Components in Different Parts of *P. utilis*

Ethnobotanical surveys revealed extensive community application of *P. utilis* fruit, leaves, and roots across all five ethnic minorities, who strongly recognize its efficacy. Leaf and fruit uses are similar (Table 3), with numerous traditional skin care applications. To systematically investigate the efficacy of different plant parts, this study selected fruit and tender leaves for modern experimental validation of traditional skin care efficacy.

Literature review of *P. utilis* phytochemistry and pharmacology indicates that while different plant parts share unified compound types, their chemical compositions differ significantly. Compounds isolated from fruit are primarily triterpenoids and steroids (Liu, 2019); those from leaves are mainly organic acids (Hu, 2006); while ethanol extracts contain primarily flavonols (Liu, 2019). These pharmacological differences in plant parts contribute to the diverse traditional uses of *P. utilis*. Water extracts from different parts exhibit varying inhibitory activities against *Escherichia coli*, *Salmonella*, *Proteus*, *Klebsiella pneumoniae*, *Staphylococcus aureus*, *Candida albicans*, *Saccharomyces cerevisiae*, and *Aspergillus niger*. Besides seasonal sampling effects, structural differences among plant parts causing chemical composition variations are the main reason for differing antimicrobial effects (Zhang et al., 2007), indicating that chemical differences lead to different efficacies and provide the material basis for diverse traditional uses.

Total flavonoid contents of three ethanol extracts are shown in Table 4 . Results indicate varying total flavonoid contents among different plant parts and processing methods, with tender leaf extract showing the highest content at $11.73 \pm 0.19$ mg/g, while fermented tender leaf extract contained only $1.24 \pm 0.01$ mg/g. Fermentation significantly affected flavonoid content, possibly due to microbial activity and enzyme production during the process.

HPLC analysis identified flavonoid compositions in extracts from different plant parts and processing methods, with ten flavonoid compounds identified across four extracts (Table 5 , Figure 3 [Figure 3: see original paper]). Fruit extract contained six flavonoid compounds, stem and leaf extract contained eight, and fermented stem and leaf extract contained nine, demonstrating that ethanol extracts contain multiple flavonoid compounds.

The study identified five skin care-related compounds: syringic acid, aurantiamarin, naringenin, quercitrin, and luteolin. Their pharmacological activities include: syringic acid—antioxidant, antibacterial, anti-inflammatory, and anti-endotoxin (Ham et al., 2016); aurantiamarin—antibacterial, anti-inflammatory, and anti-allergic (Parhiz et al., 2015); naringenin—antioxidant, antibacterial, and anti-inflammatory (Martinez et al., 2015); quercitrin—antioxidant, anti-inflammatory, antibacterial, and anti-aging (Feng et al., 2021); luteolin—antioxidant, antibacterial, anti-inflammatory, and anti-radiation (Wang et al., 2015; Liu et al., 2021).

DPPH $\cdot$ free radical scavenging results for three extracts (Figure 4: A) show that both fruit and tender leaf extracts possess scavenging capacity. At concentrations of 0.125-1 $mg \cdot mL^{-1}$, both extracts exhibited >90% scavenging, with fruit extract at 0.125 $mg \cdot mL^{-1}$ showing (95.53$±0.52)±$0.35)% clearance. Scavenging effects improved with increasing concentration. Fermented samples also performed well, though slightly lower than unfermented samples at equivalent concentrations. DPPH · scavenging effects correlated with total flavonoid content, suggesting flavonoids are the primary active scavenging compounds.

Antioxidant activity is an important indicator for evaluating vegetable oil skin care activity. DPPH · scavenging by three fruit oils from different altitudes (Figure 4: B) showed concentration-dependent effects. At 30–200 mg · mL$^{-1}$, Samples 2 and 3 had similar scavenging capacities, while Sample 1 at 30 mg · mL$^{-1}$ showed higher clearance at (52.86$\pm$1.04)$^{\{-1\}, Samples 1 and 3 showed stronger DPPH \cdot scavenging than 25 \mu g \cdot mL}${-1}$ gallic acid, with antioxidant activity reaching (96.68$\pm$0.67)%, demonstrating strong DPPH · scavenging capacity.

Linear regression equations using fruit oil concentration versus DPPH · scavenging rate yielded $IC_{50}$ values ranking as: Sample 1 (0.0168 g · mL$^{-1}$) > Sample 3 (0.0309 g · mL$^{-1}$) > Sample 2 (0.0322 g · mL$^{-1}$). Lower $IC_{50}$ indicates better scavenging capacity. Sample 1 showed the strongest DPPH · scavenging, while Sample 2 was weakest, possibly due to different antioxidant accumulation at different altitudes. Comparative studies of 11 vegetable oils (four new resource food oils, two premium edible oils, and five common vegetable oils) showed $IC_{50}$ values ranging from 0.023 g · mL$^{-1}$ for Eucommia seed oil to 0.398 g · mL$^{-1}$ for tea seed oil, with common skin care base oils including sacha inchi oil (0.055 g · mL$^{-1}$) and olive oil (0.240 g · mL$^{-1}$) (Liu et al., 2020). Sample 1' s $IC_{50}$ of 0.0168 g · mL$^{-1}$ was lower than all 11 oils, indicating superior antioxidant skin care activity.

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## 3.1 Diversity of *P. utilis* Resources and Traditional Knowledge

Ethnobotanical field investigations revealed that *P. utilis* is widely used by multiple ethnic groups in northwestern Yunnan. As one of the frequently utilized alpine plant resources in local ethnic communities, *P. utilis* exhibits rich traditional knowledge manifested through different processing methods, used parts, and food-medicine types, with diverse utilization patterns for the same plant resource across different ethnic groups. Although the period from seedling to harvest is lengthy, *P. utilis* has achieved large-scale cultivation with government support and promotion. However, the seven-year period from planting to harvest and the low fruit set rate (often less than half of flowering quantity) require in-depth research on seed biology and woody oil crop biology to address issues of fruiting cycle length and quantity. Among 840 key informants across 14 communities in northwestern Yunnan, those possessing *P. utilis* traditional knowledge are primarily aged 50 and above, with younger generations knowing little about medicinal knowledge—less than 30% of youth master knowledge of edible and industrial cultivation uses. Aligning with the Convention on Biological Diversity' s provisions on genetic resource benefit-sharing and national rural revitalization policies, community-level promotion of *P. utilis* resource conservation and utilization is needed.

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### 3.2 Analysis of Traditional Efficacy Material Basis and Skin Care Activity

This study used *P. utilis* traditional knowledge as a guide, applying modern experimental science and skin care indicators to validate traditional knowledge. For example, antioxidant activity of extracts was used as an indicator to test traditional skin care parts. Results showed extremely low $IC_{50}$ values for fruit oil, demonstrating strong DPPH · scavenging capacity that increased with concentration, validating the safety and skin cosmetic activity of traditional applications. *P. utilis* contains multiple compounds including rutin, protocatechuic acid, anthocyanins, syringic acid, aurantiamarin, naringenin, quercitrin, and luteolin, with significant antioxidant, whitening, sun protection, antibacterial, anti-allergic, and anti-aging activities. The discovery of these compound types and corresponding skin care activities in traditionally used parts provides material basis support for traditional skin care efficacy. These activities align closely with traditional efficacy records such as antibacterial and anti-inflammatory effects, demonstrating that northwestern Yunnan ethnic groups' use of *P. utilis* for dry, traumatic skin care has ethnological significance for ecological cognition, adaptation, and response. These preliminary results reveal the safety and efficacy of skin care plant applications in Naxi regions of northwestern Yunnan, illustrating consistency between traditional skin care knowledge and modern skin cosmetic activities. The correlation between traditional skin care knowledge and research findings supports the view that traditional knowledge holds scientific value and practical rationality, with a certain degree of unity between the two. This study provides ethnobotanical and ethnological methods and approaches for the conservation, inheritance, and deep utilization of *P. utilis* resources and traditional knowledge, offering preliminary applied basic research for further development.

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### 3.3 Discussion on Ethnobotanical Methods for Traditional Efficacy Verification

Cosmetics with specific cultural backgrounds and environmental sustainability are developing rapidly with intense competition. The medicinal and edible knowledge accumulated by northwestern Yunnan ethnic minorities, integrated with Han Chinese medicine knowledge and adapted to specific natural geographical environments, provides knowledge prototypes for modern cosmetic ingredient development and important guidance for sustainable plant resource utilization and conservation. With changing production and lifestyle, plant diversity and traditional knowledge face disappearance risks, urgently requiring rescue conservation, collection, organization, and functional verification as applied basic work (Yang, 2015). From ethnobotanical and natural medicinal chemistry perspectives, this study provides strong evidence and case support for plant function-oriented traditional knowledge research and conservation of resource plants and traditional knowledge.

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## References

AN Q, LIU PP, WANG DD, et al., 2017. Analysis of the active ingredient in *Prinsepia utilis* Royle fermentation liquor and its antioxidant activity[J]. *Hubei Agric Sci*, 56(7): 1326-1329.

CHINA PU, 1996. *Traditional Chinese medicine dictionary*[M]. Beijing: China Medical and Technology Publishers: 552.

DENG DQ, HAN YT, CHEN H, et al., 2008. The prevalence of photodermatosis in four regions with different altitudes in Yunnan Province of China[J]. *J Kunming Med Univ*, 5: 93-97.

FENG YL, LIU JH, XIE XN, et al., 2019. Studies on the synthesis and biological activities of quercetin derivatives[J]. *Chem Adhes*, 41(5): 344-349.

FENG YL, Li H, Liu J, et al., 2021. Research progress on therapeutic potential of quercetin[J]. *Chin J Chin MatMed*, 46(20): 5185-5193.

GAO FD, HUANG SQ, ZHANG CT, et al., 2018. Analysis of phenolic composition and antioxidant activities in fermented *Prinsepia utilis* Royle seeds[J]. *J Yunnan Minzu Univ*, 27(3): 167.

GAO FD, ZHANG CT, CAI SB, 2019. Comparative analysis of multiple nutrients, phenolic compounds and antioxidant activities of the seeds and pomace of *Prinsepia utilis* Royle[J]. *Food Ferm Industr*, 45(2): 151-158.

GUAN B, 2013. Studies on the chemical constituents of *Prinsepia utilis* Royle and anti-tumor activity[D]. Shanghai: Shanghai Jiaotong Univ: 1-100.

GUO CW, WEI RJ, NIE YF, et al., 2021. Extraction and purification of cherry plum anthocyanin and its whitening and anti-aging activity[J]. *Guangdong Chem Industry*, 48(13): 4.

HAM JR, LEI Y, YAN LY, et al., 2015. Research progress on luteolin in peanut and other plants[J]. *Chinese J Oil Crop Sci*, 37(3): 383-393.

HE DS, et al., 2018. *Yulong Materia medica* (Vol. 1) [M]. Kunming: Yunnan Scientific and Technical Publishers: 47.

HE JP, LI Y, WANG YP, et al., 2020. Germplasm resources of *Prinsepia utilis* Royle in Lijiang[J]. *J Agric*, 10(3): 55-63.

HE QJ, HE JW, WANG YP, et al., 2016. Overview of *Prinsepia utilis* Royle[J]. *Chin Agric Sci Bull*, 32(7): 74-78.

HONG S, 2015. Development of specific modification methods for catechins and structure and antioxidant activity relationship investigation[D]. Hangzhou: Zhejiang University: 1-79.

HU JY, 2006. Study on the bioactive constituents of *Prinsepia utilis* and *Astilbe chinensis*[D]. Tianjin: Tianjin University: 1-123.

INSTITUTE BJPCAS, 1990. *Xinhua compendium of materia medica* (Vol. 1)[M]. Shanghai: Shanghai Scientific and Technical Publishers: 159.

JI RF, QUAN QH, GUO XY, et al., 2019. Study on chemical composition and anti-oxidant activity of *Euonymus alatus*[J]. *Res Pract Chin Med*, 33(2): 26-29.

KAN WJ, YU WY, YU PX, et al., 2012. Anti-inflammatory effect of apigenin and its mechanism[J]. *Asia-Pacific Trad Med*, 8(1): 3.

KILIDHAR SB, PARTHASARATHY MR, SHARMA P, et al., 1982. Prinsepiol, a lignin from stems of *Prinsepia utilis*[J]. *Phytochemistry*, 21(3): 796-802.

LAN M, 1975. *Materia Medica from Yunnan* (Vol. 2)[M]. Kunming: Yunnan People' s Publishing House: 426-427.

LI G, 2019. Qualitative and quantitative analysis of anthocyanins in red onion and black soybean hull and study on their biological activities[D]. Taiyuan: Shanxi University: 1-89.

LI J, 2021. Effect of protocatechuic acid on liver inflammation induced by high fat and its mechanism[D]. Xianyang: Northwest A & F Univ: 1-54.

LI WX, LI YF, HE RR, 2016. Review of anti-oxidative evaluation methods for catechins and therapeutic mechanism of catechins[J]. *Trad Chin Drug Res Clin Pharmacol*, 27(2): 9.

LI Y, SU YY, LI GH, et al., 2021. Antagonistic effect of quercetin against oxidative pancreatic injury in diabetic rats via Nrf2 pathway[J]. *Food Sci*, 42(5): 208-214.

LIU JP, 2019. Studies on the chemical constituents of *Lespedeza cuneata* (Dum.-Cours) G. Don and *Prinsepia utilis* (Royle)[D]. Dali: Dali University: 35-46.

LIU M, GAO Y, LI KF, et al., 2021. Preparation and Physicochemical Properties of Polyethylene Glycol-modified Luteolin Liposome[J]. *Mod Food Sci Technol*, 37(10): 9.

LIU XJ, SHI JY, YI JJ, et al., 2021. The effect of in vitro simulated gastrointestinal digestion on phenolic bioaccessibility and bioactivities of *Prinsepia utilis* Royle fruits[J]. *LWT-Food Sci. Technol.*, 138(1): 110782.

LIU Y, LIU XQ, LIANG YH, et al., 2020. Comparison of fatty acid compositions and antioxidant activities of eleven vegetable oils[J]. *Chin Oils Fats*, 45(10): 52-56.

LIU YH, 2019. Investigation of chemical constituents from *Prinsepia Utilis* Royle[D]. Kunming: Kunming Medical Univ: 1-37.

MA XG, QANG ZW, TIAN B, et al., 2019. Phylogeographic analyses of the east asian endemic genus *Prinsepia* and the role of the East Asian Monsoon System in shaping a north-south divergence pattern in China[J]. *Front Genet*, 10.

MARTINEZ RM, PINHO-RIBEIRO FA, STEFFEN VS, et al., 2015. Naringenin inhibits UVB irradiation-induced inflammation and oxidative stress in the skin of hairless mice[J]. *J Nat Prod-Lloydia*, 78(7): 1647-1655.

NATIONAL CCHM, 1975. *National Compilation of Chinese herbal medicine*[M]. Beijing: People' s Medical Publishing House, 349.

PARHIZ H, ROOHBAKHSH A, SOLTANI F, et al., 2015. Antioxidant and anti-inflammatory properties of the citrus flavonoids hesperidin and hesperetin: an updated review of their molecular mechanisms and experimental models[J]. *Phytother Res*, 29(3): 323-331.

PENG Y, PENG CS, WU Y, et al., 2021. Chemical profiles of the active fraction from *Prinsepia utilis* Royle leaves and its antibenign prostatic hyperplasia evaluation in animal models[J]. *BMC Complement. Med. Ther.*, 21: 272.

PHAN M, BUCKNALL MP, ARCOT J, 2018. Interferences of anthocyanins with the uptake of lycopene in Caco-2 cells, and their interactive effects on anti-oxidation and anti-inflammation in vitro and ex vivo[J]. *Food Chem*, 276: 402-409.

SHAH K, VERMA RJ, 2012. Protection against butyl p-hydroxybenzoic acid induced oxidative stress by *Ocimum sanctum* extract in mice liver[J]. *Acta Poloniae Pharmaceutica*, 69(5): 865.

SI LJ, WANG X, WANG LL, et al., 2021. Research on anti-inflammatory and immune effects of quercetin and its partial mechanism[J]. *China Medical Herald*, 18(27): 26-29.

WANG HM, LEI Y, YAN LY, et al., 2015. Research progress on luteolin in peanut and other plants[J]. *Chinese J Oil Crop Sci*, 37(3): 383-393.

XIE XY, LIU HT, ZHANG J, et al., 2011. Study on the antioxidative activity of gallic acid in vitro[J]. *Journal of Chongqing Medical University*, 36(3): 319-322.

YANG H, DAI JL, ZHANG JL, et al., 2015. Extraction and Identification of the Flavonoides from *Prinsepia utilis* Royle[J]. *Journal of Kunming Medical University*, 36(3): 1-3.

YANG LX, 2015. Investigation and evaluation of Naxi skin care plants and their traditional knowledge[D]. Beijing: Minzu University of China: 1-134.

YUNNAN PMMC, 1993. *List of Traditional Chinese medicine resources in Yunnan*[M]. Beijing: science press: 189.

YUNNAN IMM, 2009. *The Annals of National Medicine in Yunnan* (The second volume)[M]. Kunming: The Nationalities Publishing House of Yunnan: 193-194.

YU LF, QIU Q, ZHEN DD et al., 2020. Simultaneous determination of protocatechuic acid and caffeic acid in anti-inflammatory active parts of *Sauropus spatulifolius* by HPLC[J]. *West China Journal of Pharmaceutical Sciences*, 35(6): 640-643.

ZANG ZH, CAO LP, ZHONG L, 2007. Research progress of pharmacological action and preparation of Rutin[J]. *Her Med*, 26(7): 3.

ZHAN SQ, YUAN DS, LI XT, et al., 2010. Identification and Determination of Total Flavonoids from *Prinsepia utilis* Royle[J]. *Journal of Anhui Agric Sci*, 38(28): 15580-15582, 15585.

ZHANG HN, ZHOU YF, LIU JB, et al., 2020. Exploring Protective Effects and Mechanisms of Quercetin on Liver Injury Based on Both NF- B and Nrf2 Signaling Pathways[J]. *Acta Agric Boreali-occidentalis Sinica*, 29(1): 7.

ZHANG RX, QIU BY, ZHAO J, et al., 2007. Effects of Extracts from *Prinsepia utilis* Royle on Antimicrobial Activity[J]. *Journal of Anhui Agric Sci*, (2): 408-409, 411.

ZHANG XP, LIN XY, 2005. Study of Qingciguo Oil' s function on blood lipid and other functions[J]. *J Hygiene Research*, (1): 79-81.

ZHENG XH, YANG J, YANG YH, 2017. Research progress on pharmacological effects of gallic acid[J]. *Chin J Hospital Pharmacy*, 37(1): 94-98.

*Note: Figure translations are in progress. See original paper for figures.*