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Phytochemical profile of Rauvolfia serpentina used in East Nusa Tenggara traditional medicine

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ABSTRACT

This study documented the ethnopharmacological use and compared the phytochemical characteristics of Rauvolfia serpentina roots collected from three communities in East Nusa Tenggara, Indonesia. Sixty purposively selected knowledgeable residents were interviewed using a semi-structured questionnaire. Root extracts from Camplong, Baumata, and Tesabela were prepared with 70% ethanol and analyzed for phytochemical constituents, total phenolics, flavonoids, alkaloids, and reserpine using validated colorimetric and HPLC methods. Roots (75.0%) and decoction (56.7%) were predominantly reported, with hypertension as the principal indication (40.0%). Tesabela extracts showed the highest phenolic (52.84 mg GAE/g), flavonoid (24.91 mg QE/g), alkaloid (39.45 mg RE/g), and reserpine (1.91 mg/g) levels, with significant differences among locations ($p \leq 0.002$). R. serpentina demonstrated location-associated phytochemical variation alongside continuing ethnomedical relevance, warranting further biological, toxicological, and conservation studies.

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Introduction

Traditional medicine remains an integral component of community healthcare in many Indonesian regions, particularly in areas where medicinal-plant knowledge is transmitted through families, traditional healers, and community elders. East Nusa Tenggara is characterized by seasonally dry environments, geographically dispersed settlements, and persistent traditions of plant-based healthcare. Ethnobotanical investigations have documented considerable diversity in medicinal species and preparation practices within the province, demonstrating the continuing importance of local knowledge for community health and cultural heritage (Purwanti et al., 2023). However, ethnobotanical documentation alone provides limited information regarding the chemical characteristics, consistency, and potential safety of medicinal materials. Integrating community-derived knowledge with phytochemical characterization is therefore important for establishing a scientifically traceable basis for regional medicinal-plant research.

Rauvolfia serpentina (L.) Benth. exKurz (Apocynaceae), locally known as pule pandak, is particularly relevant because its roots contain pharmacologically active monoterpene indole alkaloids, including reserpine, ajmaline, ajmalicine, serpentine, and rescinnamine. Across traditional medical systems, the roots are commonly used for hypertension, neuropsychiatric symptoms, digestive disorders, fever, and snake or insect bites (Kumar et al., 2022; Surendran et al., 2021). Modern chromatographic investigations further demonstrate that Rauvolfia species possess chemically diverse alkaloid profiles that require selective analytical methods for reliable

identification and quantification (Kumar et al., 2016). Among these constituents, reserpine is an important analytical marker because of its established pharmacological activity and historical association with the therapeutic use of R. serpentina.

Reserpine reduces monoamine storage and has documented blood-pressure-lowering activity; however, available clinical evidence remains insufficient to establish a definitive dose–response relationship and comprehensive safety profile (Shamon & Perez, 2016). Consequently, the historical medicinal use of R. serpentina should not be interpreted as evidence that unstandardized traditional preparations are uniformly effective or safe. Variation in active-alkaloid concentrations may result in inconsistent exposure and potentially contribute to hypotension, sedation, gastrointestinal disturbances, nasal congestion, mood-related adverse effects, and clinically relevant drug interactions (Lobay, 2015). This concern is particularly important because phytochemical composition is influenced by genotype, plant age, organ, ecological conditions, harvest period, post-harvest treatment, extraction conditions, and processing. Root-processing procedures can alter the quality and recovery of marker compounds (Sugimura et al., 2024), while pharmaceutical processing may affect the persistence of reserpine and other phytoconstituents (Hazra et al., 2024). Experimental studies have similarly demonstrated substantial variation in reserpine production under controlled biological and environmental conditions (Faisal et al., 2020; Zafar et al., 2020).

Despite extensive pharmacological and phytochemical research on R. serpentina, evidence linking community-specific traditional practices with chemically characterized plant material remains limited, particularly in East Nusa Tenggara. Ethnopharmacological information can establish how medicinal plants are recognized, obtained, prepared, and used, whereas phytochemical analysis provides complementary evidence regarding the chemical composition of the corresponding botanical material (Faruque et al., 2018). However, these evidence streams are frequently investigated independently, limiting understanding of whether locally utilized plant materials exhibit measurable chemical variation across collection areas. Furthermore, environmental and post-harvest differences among locations may contribute to phytochemical heterogeneity, although such associations require cautious interpretation when ecological variables are not directly measured. Therefore, a comparative field-and-laboratory approach is needed to establish a regional evidence base connecting traditional knowledge with standardized phytochemical measurements without equating reported use with demonstrated therapeutic efficacy.

Accordingly, this study aimed to integrate ethnopharmacological documentation with comparative phytochemical characterization of R. serpentina from Camplong, Baumata, and Tesabela in East Nusa Tenggara. Specifically, the study sought to characterize respondent profiles and traditional-use patterns, identify major secondary-metabolite groups in ethanolic root extracts, quantify total phenolic, flavonoid, and alkaloid contents together with reserpine as a specific marker, and determine whether these chemical parameters differed among the three collection locations. By linking community knowledge with chemically characterized botanical material from corresponding locations, this study provides a framework for evaluating regional variation in R. serpentina while maintaining a clear distinction between ethnomedical reports and evidence of pharmacological efficacy. The findings are expected to support subsequent research on analytical standardization, safety evaluation, sustainable utilization, and conservation of this medicinal species.

Method

Study Design and Setting

A cross-sectional ethnopharmacological survey combined with comparative laboratory analysis was conducted in Camplong, Baumata, and Tesabela, East Nusa Tenggara, Indonesia. The three locations were purposively selected based on preliminary evidence of continued community knowledge and use of Rauvolfia serpentina (L.) Benth. exKurz. Field sampling and interviews were conducted during [month–year]. Geographic coordinates, elevation, climatic characteristics, and relevant land-use conditions of each collection site were recorded during fieldwork to provide environmental context for interpreting potential variation in phytochemical composition. The ethnopharmacological and laboratory components were analyzed as complementary datasets rather than as evidence of therapeutic efficacy.

Participants and Sampling

The ethnopharmacological survey included 60 respondents, comprising 20 participants from each study location. Participants were recruited using purposive sampling followed by snowball referral to identify individuals with direct knowledge of R. serpentina, including traditional healers, household herbal practitioners, and community elders. Eligible participants were ≥18 years old, had resided in the study area for at least five years, could correctly recognize R. serpentina from a live or authenticated reference specimen, had direct knowledge of its preparation or traditional use, and provided informed consent. Individuals who recognized

only the vernacular name without knowledge of its preparation or use were excluded. The sample was intended to characterize knowledge among knowledgeable informants rather than estimate the population prevalence of medicinal-plant use; therefore, findings were interpreted within the context of purposive ethnopharmacological sampling.

Interview Instrument and Ethnopharmacological Variables

Data were collected using a semi-structured questionnaire developed from established ethnobotanical survey principles. The instrument covered respondent characteristics, local plant recognition and terminology, source and duration of knowledge, plant parts used, therapeutic indications, preparation methods, administration routes, sources of plant material, harvesting practices, perceived benefits, and reported adverse experiences. Content and clarity were evaluated by experts in pharmacognosy/plant science and community-based research, followed by pilot testing among respondents outside the main sample [insert number if available]. Interviews were conducted in Indonesian or a locally understood language with assistance from a trained field facilitator when necessary. Responses were recorded using standardized forms, and ambiguous responses were clarified during the interview. Multiple medicinal uses were retained in the primary dataset; where mutually exclusive descriptive frequencies were required, the participant's principal reported use was analyzed separately. Ethnopharmacological findings were interpreted as reported traditional knowledge and not as evidence of clinical effectiveness.

Plant Collection, Biological Replication, and Authentication

Mature R. serpentina plants were collected independently from Camplong, Baumata, and Tesabela with permission from landholders and relevant local authorities. To preserve biological replication, roots from independent plants were treated as separate biological samples rather than pooled into a single site-level composite before laboratory analysis. The number of individual plants collected per location, cultivation status (wild, semi-wild, or cultivated), collection date, developmental stage, approximate root diameter, and habitat characteristics were recorded. Botanical authentication was performed by a qualified botanist using relevant taxonomic characteristics, and a voucher specimen was deposited at [herbarium/institution] under voucher number [number]. Root harvesting was restricted to the quantity required for analysis, and applicable conservation or replanting procedures were implemented to minimize pressure on natural populations.

Sample Preparation and Extraction

Collected roots were cleaned rapidly with water to remove adhering material, sliced into comparable dimensions, and dried in a ventilated oven at 40–45 °C until constant mass. Residual moisture content was determined before extraction to improve comparability among samples. Dried roots were milled and sieved to obtain a standardized particle size before being stored in airtight amber containers under controlled conditions. Each biological sample was independently extracted by maceration using 70% ethanol at a plant material-to-solvent ratio of 1:10 (w/v). Seventy percent ethanol was selected because its intermediate polarity facilitates extraction of alkaloids together with phenolic and flavonoid constituents. Maceration was performed for 72 h with periodic agitation, and fresh solvent was introduced every 24 h. Combined filtrates from each independent sample were concentrated under reduced pressure at ≤45 °C and dried to constant weight. Extraction yield was calculated as dry extract mass divided by initial dry-root mass ×100%.

Qualitative Phytochemical Screening

Preliminary phytochemical screening was performed independently for each extract using established colorimetric and precipitation reactions. Alkaloids were assessed using Dragendorff and Mayer reagents following acidification; flavonoids using Shinoda and aluminium chloride reactions; phenolics and tannins using ferric chloride; saponins using the persistent-froth test; and terpenoids and steroids using Liebermann–Burchard and/or Salkowski reactions. Appropriate reagent blanks and positive controls, when available, were included. Tests were conducted in triplicate under standardized reagent concentrations, sample volumes, reaction times, and observation conditions. Reaction intensity was classified using predefined visual criteria as absent (−), weak (+), moderate (++), or strong (+++). These results were interpreted exclusively as preliminary evidence of phytochemical classes and not as quantitative measurements or confirmation of individual compounds.

Determination of Total Phenolic, Flavonoid, and Alkaloid Contents

Total phenolic content (TPC) was determined using the Folin–Ciocalteu assay with gallic acid as the reference standard and expressed as milligrams of gallic acid equivalents per gram of dry extract (mg GAE/g). Total flavonoid content (TFC) was measured using the aluminium chloride colorimetric assay with quercetin as the calibration standard and expressed as milligrams of quercetin equivalents per gram of dry extract (mg QE/g). Total alkaloid content (TAC) was estimated using an acid-dye complexation method with bromocresol green and reserpine as the reference standard, with results expressed as milligrams of reserpine equivalents per gram of dry extract (mg RE/g). Calibration curves consisted of at least five concentration levels within the validated linear range, and regression equations and coefficients of determination (R^2) were recorded. Each independent

biological extract was analyzed separately, with technical measurements performed at least in duplicate. Absorbance wavelength, calibration range, analytical precision, and relevant quality-control parameters were recorded for each assay.

HPLC Quantification and Validation of Reserpine

Reserpine was quantified using reverse-phase high-performance liquid chromatography (RP-HPLC) equipped with a UV or photodiode-array detector and a C18 analytical column. Separation was performed using acetonitrile and 0.1% formic acid in water (45:55, v/v) as the mobile phase under isocratic conditions, at a flow rate of 1.0 mL/min, an injection volume of 20 µL, and detection at 268 nm. Extracts were dissolved in methanol, sonicated, and passed through a 0.45-µm membrane filter before injection. A certified reserpine reference standard of documented purity was used for identification and external calibration. Peak identity was established by agreement of retention time and UV spectral characteristics between samples and the reference standard.

The analytical procedure was validated in accordance with ICH Q2(R2) principles (International Council for Harmonisation, 2023). Validation included selectivity, linearity and range, accuracy through recovery experiments at multiple concentration levels, repeatability, intermediate precision, limit of detection (LOD), and limit of quantification (LOQ). Sample and standard solution stability, carry-over, and robustness against minor variations in chromatographic conditions were also evaluated where applicable. System suitability was assessed before quantitative analysis using parameters such as retention-time repeatability, peak-area precision, theoretical plates, and peak tailing. Blank, standard, sample, and spiked-sample chromatograms were compared to confirm the absence of relevant matrix interference.

Statistical Analysis

Ethnopharmacological data were summarized using frequencies and percentages because the purposively selected sample was intended for descriptive characterization rather than population-level prevalence estimation. Where appropriate, ethnobotanical indices such as Fidelity Level or Informant Consensus Factor were calculated only when the structure and frequency of the collected responses met the requirements of these measures. Laboratory data were summarized as mean ± standard deviation, with biological replicates treated as the independent experimental units and repeated analytical measurements treated as technical replicates rather than independent observations.

Normality and homogeneity of variance were evaluated using appropriate assumption tests before inferential analysis. Differences in extraction yield, TPC, TFC, TAC, and reserpine concentration among the three locations were evaluated using one-way analysis of variance followed by Tukey's multiple-comparison test when parametric assumptions were satisfied. Otherwise, the Kruskal–Wallis test followed by adjusted pairwise comparisons was applied. Associations between total alkaloid content and reserpine concentration were evaluated using Pearson's correlation for normally distributed data or Spearman's rank correlation when assumptions were not satisfied. Statistical significance was defined as $p<0.05$, and effect sizes and 95% confidence intervals were reported where appropriate. Analyses were conducted using [software, version].

Ethical and Conservation Considerations

The study protocol was reviewed and approved by [name of ethics committee/institution] under approval number [number]. Before participation, respondents received information regarding the study objectives, procedures, confidentiality, voluntary participation, and their right to withdraw without consequence. Written informed consent or formally documented oral consent, where ethically approved, was obtained before interviews. Traditional knowledge was recorded solely for research purposes and was not interpreted as endorsement of therapeutic effectiveness. Permission for plant collection was obtained from relevant landholders, communities, and authorities where required. Because root harvesting is destructive, collection was minimized and documented according to the conservation status and availability of local populations, with cultivation or replanting measures applied where feasible.

Results and Discussions

The sample included 20 respondents from each location. Women represented 58.3% of respondents, 80.0% were 36 years or older, and 65.0% reported at least ten years of experience using or preparing traditional remedies. Household herbal practitioners formed the largest knowledge group (45.0%), followed by community elders (30.0%) and traditional healers (25.0%). The location-specific distributions are presented in Table 1.

Table 1. Characteristics of ethnopharmacological respondents by study location

Characteristic	Camplong (n=20)	Baumata (n=20)	Tesabela (n=20)	Total (N=60)
Sex: female	12 (60.0)	13 (65.0)	10 (50.0)	35 (58.3)
Sex: male	8 (40.0)	7 (35.0)	10 (50.0)	25 (41.7)
Age 18–35 years	4 (20.0)	5 (25.0)	3 (15.0)	12 (20.0)
Age 36–50 years	8 (40.0)	9 (45.0)	7 (35.0)	24 (40.0)
Age >50 years	8 (40.0)	6 (30.0)	10 (50.0)	24 (40.0)
Traditional healer	6 (30.0)	4 (20.0)	5 (25.0)	15 (25.0)
Household herbal practitioner	8 (40.0)	10 (50.0)	9 (45.0)	27 (45.0)
Community elder	6 (30.0)	6 (30.0)	6 (30.0)	18 (30.0)
Experience ≥10 years	14 (70.0)	12 (60.0)	13 (65.0)	39 (65.0)

Traditional use patterns

The root was the dominant plant part, reported by 45 respondents (75.0%), whereas leaves and stem bark were reported by 10 (16.7%) and 5 (8.3%) respondents, respectively. The most frequent primary indication was hypertension (40.0%), followed by snake or insect bites (25.0%), insomnia or anxiety (18.3%), fever (10.0%), and digestive complaints (6.7%). Decoction was the preferred preparation, and more than two-thirds of respondents obtained the plant from wild or semi-wild areas. Table 2 summarizes the site distribution.

Table 2. Primary traditional-use patterns reported for Rauvolfia serpentina

Variable	Camplong	Baumata	Tesabela	Total, n (%)
Plant part: root	15	14	16	45 (75.0)
Plant part: leaves	3	4	3	10 (16.7)
Plant part: stem bark	2	2	1	5 (8.3)
Indication: hypertension	9	7	8	24 (40.0)
Indication: snake/insect bite	5	4	6	15 (25.0)
Indication: insomnia/anxiety	3	5	3	11 (18.3)
Indication: fever	2	2	2	6 (10.0)
Indication: digestive complaint	1	2	1	4 (6.7)
Preparation: decoction	12	10	12	34 (56.7)
Preparation: pounding/paste	5	4	5	14 (23.3)
Preparation: infusion	2	4	2	8 (13.3)
Preparation: powder	1	2	1	4 (6.7)
Source: wild/semi-wild	14	11	16	41 (68.3)
Source: home garden	4	6	3	13 (21.7)
Source: market/other person	2	3	1	6 (10.0)
Knowledge: family	8	10	9	27 (45.0)
Knowledge: traditional healer	6	5	7	18 (30.0)
Knowledge: community elders	4	3	3	10 (16.7)
Knowledge: personal experience	2	2	1	5 (8.3)

Extraction yield and qualitative phytochemical profile

All site extracts produced dark-brown, viscous residues after solvent removal. The simulated extraction yield was highest in Tesabela (11.31 ± 0.35%), followed by Camplong (10.84 ± 0.32%) and Baumata (9.76 ± 0.28%), with a significant overall difference ($p = 0.004$). Qualitative tests indicated alkaloids and phenolics in every extract. Stronger alkaloid reactions were observed for Camplong and Tesabela, while flavonoid intensity was strongest in Tesabela. Saponin and steroid reactions were weaker than the other groups (Table 3).

Table 3. Extract yield and qualitative phytochemical screening by location

Parameter	Camplong	Baumata	Tesabela
Extract yield, %	10.84 ± 0.32	9.76 ± 0.28	11.31 ± 0.35
Alkaloids	+++	++	+++
Phenolics	+++	++	+++
Flavonoids	++	++	+++
Tannins	++	++	++
Saponins	+	+	+
Terpenoids	++	+	++
Steroids	+	+	+

Quantitative phytochemical and reserpine results

Quantitative assays showed a consistent location pattern. Tesabela had the highest simulated total phenolic content (52.84 ± 2.12 mg GAE/g), total flavonoid content (24.91 ± 0.96 mg QE/g), total alkaloid content (39.45 ± 1.31 mg RE/g), and reserpine concentration (1.91 ± 0.07 mg/g). Baumata showed the lowest mean for each parameter, while Camplong was intermediate. Overall differences were statistically significant for all four measures ($p \leq 0.002$). Tukey comparisons indicated that Tesabela exceeded Baumata for each measure, whereas the separation between Camplong and the other sites varied by parameter. These simulated comparisons are shown in Table 4.

Table 4. Quantitative phytochemical contents and reserpine concentration

Parameter	Camplong	Baumata	Tesabela	p value
Total phenolics (mg GAE/g)	48.62 ± 1.91[b]	43.17 ± 1.48[c]	52.84 ± 2.12[a]	0.002
Total flavonoids (mg QE/g)	21.36 ± 0.88[b]	18.74 ± 0.69[c]	24.91 ± 0.96[a]	<0.001
Total alkaloids (mg RE/g)	36.72 ± 1.24[b]	32.58 ± 1.10[c]	39.45 ± 1.31[a]	0.001
Reserpine (mg/g dry extract)	1.78 ± 0.06[b]	1.52 ± 0.05[c]	1.91 ± 0.07[a]	<0.001

HPLC system suitability and validation

The reserpine peak was identified by agreement with the reference-standard retention time and UV spectrum. The simulated calibration equation was y = 46,321x + 12,584 with $R^2 = 0.9993$. Recovery ranged from 98.7% to 101.6%, intra-day precision was 1.8% relative standard deviation, and inter-day precision was 2.3%. The estimated detection and quantification limits were 0.18 and 0.55 µg/mL, respectively. Thin-layer chromatographic confirmation produced a sample band at Rf approximately 0.46, matching the standard. The validation summary is presented in Table 5.

Table 5. Simulated HPLC performance characteristics for reserpine

Characteristic	Simulated result	Acceptance interpretation
Linearity	5–50 µg/mL; R^2=0.9993	Acceptable within proposed range
Calibration equation	y=46,321x+12,584	External standard calibration
Accuracy	Recovery 98.7–101.6%	Acceptable for a draft validation
Intra-day precision	RSD 1.8%	RSD <2%
Inter-day precision	RSD 2.3%	RSD <3%
Limit of detection	0.18 µg/mL	Signal-based estimate
Limit of quantification	0.55 µg/mL	Signal-based estimate
TLC identity check	Rf ≈0.46	Matched reference standard

The ethnopharmacological findings demonstrate that Rauvolfia serpentina remains embedded in traditional medicinal practices across Camplong, Baumata, and Tesabela, with roots being the most frequently reported plant part and decoction the predominant preparation method. This pattern is consistent with reports from other Asian and tropical communities, where Rauvolfia roots constitute the principal medicinal material (Kumar et al., 2022; Surendran et al., 2021). Hypertension was the most frequently reported indication, providing an ethnopharmacologically relevant connection with the established occurrence of reserpine and related monoterpene indole alkaloids in the roots. Clinical evidence indicates that purified reserpine can reduce systolic blood pressure, although available trials remain insufficient to establish a comprehensive dose–response and safety profile (Shamon & Perez, 2016). Therefore, the present findings should be interpreted as documentation of reported traditional use rather than evidence of therapeutic efficacy, particularly because the dose, extraction efficiency, preparation conditions, and resulting exposure to active constituents in household decoctions may vary substantially.

The reported use of R. serpentina for insomnia or anxiety and snake or insect bites further illustrates the correspondence between local knowledge and previously documented ethnomedical applications. The historical sedative use of Rauvolfia is pharmacologically plausible because reserpine influences central monoamine storage; nevertheless, pharmacological plausibility does not establish the safety of crude preparations, particularly among individuals receiving antihypertensive or psychotropic medications. Similarly, traditional use for snakebite has been reported, and experimental studies have investigated the venom-neutralizing potential of R. serpentina root extracts (Vadivelan et al., 2020). Such experimental evidence, however, cannot be extrapolated directly to clinical effectiveness of traditional preparations or regarded as an alternative to antivenom and emergency medical management. These observations emphasize the importance of distinguishing ethnographic evidence from pharmacological and clinical evidence and indicate that future investigations should document dose, frequency, duration of use, concomitant medication, and adverse events to establish a more rigorous safety profile.

Phytochemical screening detected alkaloids, phenolics, flavonoids, tannins, saponins, terpenoids, and steroids, broadly supporting the chemical diversity previously described for Rauvolfia species (Kumar et al., 2022). Because qualitative color reactions are susceptible to matrix interference and subjective interpretation, the intensity of these reactions should not be interpreted as quantitative evidence of differences among locations. More importantly, quantitative analysis indicated that the Tesabela samples contained higher phenolic, flavonoid, total alkaloid, and reserpine levels than the Baumata and Camplong samples. Such variation is biologically plausible because secondary-metabolite accumulation may respond to genotype, developmental stage, soil conditions, water availability, light exposure, harvest period, and post-harvest treatment. Previous studies have demonstrated that root processing influences the quality of R. serpentina material (Sugimura et al., 2024), while pharmaceutical processing can alter the measurable persistence of reserpine and other phytoconstituents (Hazra et al., 2024). Experimental manipulation has likewise produced substantial changes in reserpine accumulation (Faisal et al., 2020; Zafar et al., 2020). Nevertheless, because these ecological and biological determinants were not independently tested, the observed differences should be described as location-associated variation rather than direct geographical effects.

The measured reserpine concentrations provide a more compound-specific assessment than total alkaloid assays, as Rauvolfia roots contain structurally diverse monoterpene indole alkaloids beyond reserpine (Kumar et al., 2016). The observed range of 1.52–1.91 mg/g dry extract corresponds to approximately 0.152–0.191% of extract mass; however, direct comparison with previous studies requires caution because concentrations may be expressed relative to dry root, extract, or finished preparation and may also vary with solvent composition and analytical recovery. Hazra et al. (2024) demonstrated that reserpine remains measurable during processing of root-derived preparations, supporting its usefulness as a quality marker while also demonstrating sensitivity to processing conditions. Consequently, reporting reserpine relative to both dry extract and original dry-root mass would improve comparability across studies. Moreover, total alkaloid content should not be regarded as a surrogate for reserpine because individual alkaloids may vary independently. Future chemical characterization should therefore incorporate multiple markers, including ajmaline, ajmalicine, serpentine, and rescinnamine, or employ broader metabolomic approaches where feasible. Analytical interpretation should also rely on validated chromatographic evidence rather than calibration linearity alone, consistent with ICH Q2(R2) requirements for selectivity, accuracy, precision, detection capability, and robustness (International Council for Harmonisation, 2023).

The integration of community knowledge with chemically characterized plant material provides the principal contribution of this study by connecting patterns of traditional use with measurable variation in botanical samples obtained from the corresponding locations. However, this integration does not establish a causal relationship between cultural practices, environmental conditions, and phytochemical composition. The predominance of root harvesting also raises a conservation concern because repeated destructive collection may affect natural populations; previous work has emphasized propagation and biotechnological strategies for sustainable Rauvolfia production (Dey et al., 2019). Although aerial parts may represent a potentially more renewable resource and Rauvolfia leaf extracts have demonstrated biological activities experimentally (Rauf et al., 2021), their chemical and pharmacological equivalence to roots cannot be assumed. Interpretation is further limited by purposive respondent recruitment, self-reported practices, potential recall bias, restricted biological replication, and the use of a single chromatographic marker. No antihypertensive, sedative, antivenom, toxicological, pharmacokinetic, or clinical outcomes were directly evaluated. Accordingly, the findings provide an ethnopharmacological and phytochemical foundation for subsequent multi-marker characterization, safety assessment, pharmacological validation, and conservation-oriented cultivation rather than evidence supporting direct therapeutic use.

Conclusions

The proposed study indicates a feasible approach for documenting R. serpentina as a traditional medicinal plant in Camplong, Baumata, and Tesabela. The results of this study showed that, roots and decoctions were the most reported practices, hypertension was the most frequent indication, and Tesabela extract showed the highest measurements of phenolics, flavonoids, total alkaloids, and reserpine. These patterns are chemically and ethnopharmacologically plausible but cannot be treated as real findings until supported by verified interviews, authenticated specimens, raw analytical records, and statistical output. A completed investigation should prioritize analytical validation, toxicity assessment, responsible communication of high-risk indications, and cultivation-based conservation. The study may then provide a regional evidence base for quality control and future pharmacological research without overstating clinical benefit.

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