



Determination of Total Polyphenol and Flavonoid Content in Reundeu Herb (*Staurogyne elongata*) Using Folin-Ciocalteu and Aluminum Chloride Methods

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Abstract. *Reundeu*, botanically identified as *Staurogyne elongata* and classified within the family Acanthaceae, is a folk remedy long used in West Java to manage urinary tract complaints and promote diuresis. Its tissues accumulate secondary metabolites, notably polyphenolic and flavonoid constituents, which are widely associated with antioxidant activity. The present study aimed to quantify the total polyphenol content (TPC) and total flavonoid content (TFC) present in a 96% ethanolic extract of the herb. Raw material was harvested from Kampung Adat Cireundeu, Cimahi, with its botanical identity confirmed by the Indonesian Institute of Sciences (LIPI), and the dried herb was macerated in 96% ethanol. Both the raw material powder and resulting extract underwent phytochemical screening, while thin-layer chromatography (TLC) was applied for qualitative confirmation of the target compound classes. TPC was quantified using the Folin-Ciocalteu colorimetric assay referenced against gallic acid (reported as mg GAE/g extract), whereas TFC was assessed using the aluminum chloride ($AlCl_3$) colorimetric assay referenced against quercetin (reported as % w/w quercetin equivalent). Physicochemical evaluation of the raw material yielded a moisture content of $4.31\% \pm 0.5$, a total ash content of $24.48\% \pm 0.93$, and a water-soluble extractable-matter value of $34.36\% \pm 0.88$. Screening results indicated the presence of polyphenols, flavonoids, quinones, monoterpenoid-sesquiterpenoid compounds, and triterpenoids. The extract's TPC was 37.98 ± 0.98 mg GAE/g, while its TFC was $7.01 \pm 0.40\%$ w/w quercetin equivalent (equal to roughly 70 mg QE/g). Collectively, these results provide preliminary phytochemical reference data for authenticated Reundeu raw material and extract, contributing baseline information for future chemical standardization of the species. Antioxidant and other biological activities were not assessed and remain to be demonstrated in future studies.

Keywords: *Staurogyne elongata*; polyphenol; flavonoid; Folin-Ciocalteu; aluminum chloride.

Type of the Paper: Regular Article.



1. Introduction

Across the Indonesian archipelago, medicinal plants have long formed the backbone of community healthcare, providing accessible remedies for a broad spectrum of illnesses [1,2]. This reliance on native flora reflects a cultural tradition that predates the arrival of modern pharmaceutical products, with local communities continuing to draw on botanical knowledge passed down through generations.

Staurogyne elongata, known locally as "Reundeu" among the Sundanese of West Java, is a creeping herb in the family Acanthaceae [3,4]. In Sundanese folk medicine, its roots and leaves are used as a diuretic and to relieve urinary tract complaints, while its young foliage is eaten as a

fresh vegetable.

Phytochemically, members of the Acanthaceae family are recognized as a rich reservoir of secondary metabolites, encompassing polyphenols, flavonoids, alkaloids, and terpenoids [4,5]. Polyphenolic constituents, in particular, have drawn substantial research interest owing to their well-established antioxidant, anti-inflammatory, antimicrobial, and hepatoprotective properties [6,7]. Mechanistically, polyphenols neutralize free radicals via electron- or hydrogen-atom-transfer pathways, limiting oxidative damage to key biomolecules.

Among polyphenolic compounds, flavonoids represent the largest class found across the plant kingdom and are characterized by a C₆-C₃-C₆ diphenylpropane skeleton [8]. Their antioxidant activity is primarily explained by their capacity to donate hydrogen atoms from phenolic hydroxyl groups to reactive oxygen species [9].

Even so, *S. elongata* has received comparatively little rigorous phytochemical attention in the peer-reviewed literature [10]. Its scientific relevance stems from a feature not common to all Acanthaceae species: it is consumed directly as a fresh vegetable while simultaneously being used as a folk diuretic and antiurolithiasis remedy. Thus, any phytochemical or quality-control data generated for this species have direct relevance to a population already exposed to the plant through diet, rather than solely through processed medicine. Existing published work on *S. elongata* is limited to agronomic propagation and shoot-pruning studies [10]; no species-specific, quantitatively standardized reference values for its polyphenol or flavonoid content have previously been reported. This absence of a validated phytochemical baseline represents the specific gap that this study addresses, as without such reference values, neither raw material quality control nor future pharmacological studies on this species can be meaningfully benchmarked against a known standard. TPC is conventionally quantified through the Folin-Ciocalteu (FC) colorimetric assay [11], whereas TFC determination typically relies on the aluminum chloride (AlCl₃) colorimetric approach [12,13]. Building on this gap, the present study generated the first standardized TPC and TFC reference values for authenticated *S. elongata* raw material and ethanolic extract under a clearly defined extraction and analytical protocol. These values provide a phytochemical baseline for future quality-control and pharmacological studies of this species. Beyond serving as an analytical reference, such standardized baseline data can support future agricultural cultivation planning, medicinal-plant quality assessment, and formal pharmacopoeial standardization of *S. elongata* raw material.

2. Materials and Methods

2.1. Plant Material and Authentication

Staurogyne elongata, specifically the whole herb (aerial parts, comprising stems and leaves),

was collected from Cireundeu Traditional Village (Kampung Adat Cireundeu), Leuwigajah, Cimahi, West Java, Indonesia. The plant material was washed under running water, drained, dried at ambient temperature for 48 hours, and subsequently milled to obtain a fine raw material powder, which was stored in a sealed container for further processing.

2.2. *Raw Material Characterization*

Macroscopic evaluation of the raw material powder was conducted by direct organoleptic observation, including surface texture, color, odor, and dimensions. Microscopic examination was conducted on a representative powder sample using a binocular microscope at 100× magnification after mounting the powder sample in a chloral hydrate solution on a glass slide, in the presence of a chloral hydrate mounting medium to reveal specific histological markers. Physicochemical parameters were determined according to the standardized procedures of the Indonesian Pharmacopoeia [14].

2.3. *Preparation of Ethanolic Extract*

Extraction of the raw material was performed by maceration: a 500 g portion of the powder was macerated in 96% ethanol (v/v) at ambient temperature for 72 hours with intermittent agitation on an orbital shaker (IKA KS 260). The extraction consisted of a single maceration using 2 L of 96% ethanol, corresponding to a solvent to material ratio of 1:4 (w/v). High-concentration (96%) ethanol was selected because it favors the co-extraction of both moderately polar phenolic acids and less polar flavonoid aglycones, with its effectiveness for phenolic-compound recovery well established relative to lower-concentration ethanol systems. The macerate was passed through Whatman No. 41 filter paper, after which the filtrate was concentrated under reduced pressure using a rotary evaporator until a thick extract of uniform consistency was achieved. Extraction yield was then calculated as the proportion of extract mass relative to the starting raw material mass [15]; the resulting extraction yield is reported in the Results section.

2.4. *Phytochemical Screening*

Both the raw material powder and the ethanolic extract were subjected to qualitative phytochemical screening for alkaloids (Mayer's and Dragendorff's reagents), flavonoids (magnesium powder-hydrochloric acid reduction test), polyphenols (ferric chloride test), tannins (gelatin and Stiasny's reagent), saponins (foam test), monoterpenoids/sesquiterpenoids (vanillin-sulfuric acid reagent), steroids/triterpenoids (Liebermann-Burchard reagent), and quinones (potassium hydroxide reagent), following procedures adapted from established phytochemical screening protocols [1,2].

2.5. *Thin-Layer Chromatography (TLC) Profiling*

Qualitative identification of polyphenolic and flavonoid compounds was performed by TLC

on silica gel GF₂₅₄ plates. The mobile phase consisted of methanol:chloroform (3:7, v/v). Detection was performed by visualization under UV light at 254 nm and 365 nm, followed by spraying with 5% ferric chloride (FeCl₃) for polyphenols and sequentially with ammonia (NH₃), aluminum chloride (AlCl₃), and citroborate reagent for flavonoids. Retardation factor (Rf) values were calculated for each resolved spot [16].

2.6. Determination of Total Polyphenol Content

TPC was assessed using the Folin-Ciocalteu (FC) colorimetric assay [11]. A gallic acid calibration curve was built across 4, 5, 6, 7, 8, and 9 µg/mL in methanol:water (50:50, v/v). For each standard or sample, a 0.5 mL aliquot was combined with 5 mL of FC reagent (diluted 1:10) and 4 mL of 1 M sodium carbonate (Na₂CO₃). Following a 15-minute incubation at room temperature, absorbance was measured at 764.8 nm using a UV-Visible spectrophotometer (Shimadzu UV-1800). TPC was reported as milligrams of gallic acid equivalents per gram of dry extract (mg GAE/g) based on three independently prepared and independently measured replicate determinations [17].

2.7. Determination of Total Flavonoid Content

TFC was determined using the AlCl₃ colorimetric assay [12]. A quercetin calibration curve spanning concentrations of 50, 60, 70, 80, 90, and 100 µg/mL in 80% ethanol was prepared. A 0.5 mL aliquot of each standard or sample was placed in a 10 mL volumetric flask together with 1.5 mL of 95% ethanol, 0.1 mL of 10% AlCl₃, and 0.1 mL of 1 M potassium acetate, then brought to volume with distilled water. Absorbance was recorded at 434.5 nm (Shimadzu UV-1800) after a 30-minute incubation, and TFC was expressed as a percentage of quercetin equivalent (% w/w QE) based on three independently prepared and independently measured replicate determinations [12,13].

2.8. Statistical Analysis

Descriptive statistics, including mean and standard deviation, were calculated for all quantitative measurements using Microsoft Excel. Results are expressed as mean ± SD from triplicate determinations.

3. Results and Discussion

3.1. Plant Authentication and Raw Material Preparation

Staurogyne elongata was successfully authenticated at the Herbarium Bogoriense, Indonesian Institute of Sciences (LIPI), confirming the botanical identity of the plant material used in this study. The authenticated raw material powder was produced with a yield of 3.17%, consistent with the water-removing efficiency of ambient drying and conventional milling. Maceration of the raw material powder in 96% ethanol yielded an extraction yield of 5.8% w/w

relative to the starting raw material mass.

3.2. Macroscopic and Microscopic Characterization

Macroscopic evaluation of the raw material (Fig. 1) revealed the characteristic physical features summarized in Table 1. A rough surface texture, dark brownish-green coloration, weak odor, and tasteless profile were observed, with the leaves measuring approximately 15 cm in length and 14 cm in width. These morphological traits align with previously published botanical descriptions of *S. elongata* [3,10].

Table 1. Macroscopic examination of Reundeu (*Staurogyne elongata*) herb raw material.

Parameter	Observation Result
Surface Texture	Rough
Color	Dark brownish-green
Odor	Weak odor
Taste	Tasteless
Dimensions	Length: 15 cm; Width: 14 cm



Fig. 1. Macroscopic appearance of *Staurogyne elongata* herb raw material.

Under the microscope, the raw material powder displayed several histological markers characteristic of Reundeu herb, namely oil cells (secretory cells), sclerenchyma fibers, cortical parenchyma fragments, trichomes (covering hairs), and calcium oxalate crystals (Fig. 2). Collectively, these microscopic features function as diagnostic taxonomic markers useful for identifying and authenticating the plant material.

3.3. Physicochemical Characterization of Raw Material

The results of physicochemical characterization are summarized in Table 2. The moisture content ($4.31\% \pm 0.5$) complied with the general maximum permissible moisture limit recommended for herbal raw materials under established herbal-drug standardization practice [14], consistent with the requirement of Indonesian Minister of Health Decree No. 661/MENKES/SK/VII/1994 for traditional medicinal plant materials. The total ash value ($24.48\% \pm 0.93$) reflects both physiological and non-physiological mineral residues within the plant material, while the acid-insoluble ash fraction ($21.4\% \pm 0.2$) is largely attributable to silica picked

up from the surrounding environment. The comparatively high total ash value observed for this raw material may reflect environmental mineral accumulation associated with the collection site and soil composition, as well as the plant's uptake of soil-derived silica and other minerals during growth. This pattern aligns with the edaphic conditions at the collection site: Kampung Adat Cireundeu (Kelurahan Leuwigajah, Kecamatan Cimahi Selatan, Kota Cimahi, West Java) lies at approximately 700–850 m above sea level on hilly terrain formed from Quaternary volcanic weathering material, with soils dominated by Latosol (Inceptisols) and Andosol (Andisols) types that are characteristically mineral-rich (slightly acidic to neutral pH of 5.5–6.5; moderate-to-high cation exchange capacity of 20–35 meq/100 g) [18]. This volcanic soil origin plausibly explains the elevated total ash and acid-insoluble ash values recorded here, reflecting greater environmental silica and mineral uptake by the plant relative to material grown on non-volcanic soils. Because water-soluble extractable matter ($34.36\% \pm 0.88$) exceeded the ethanol-soluble fraction ($12.30\% \pm 0.43$), the dominant constituents of the herb appear to favor polar solvent systems.

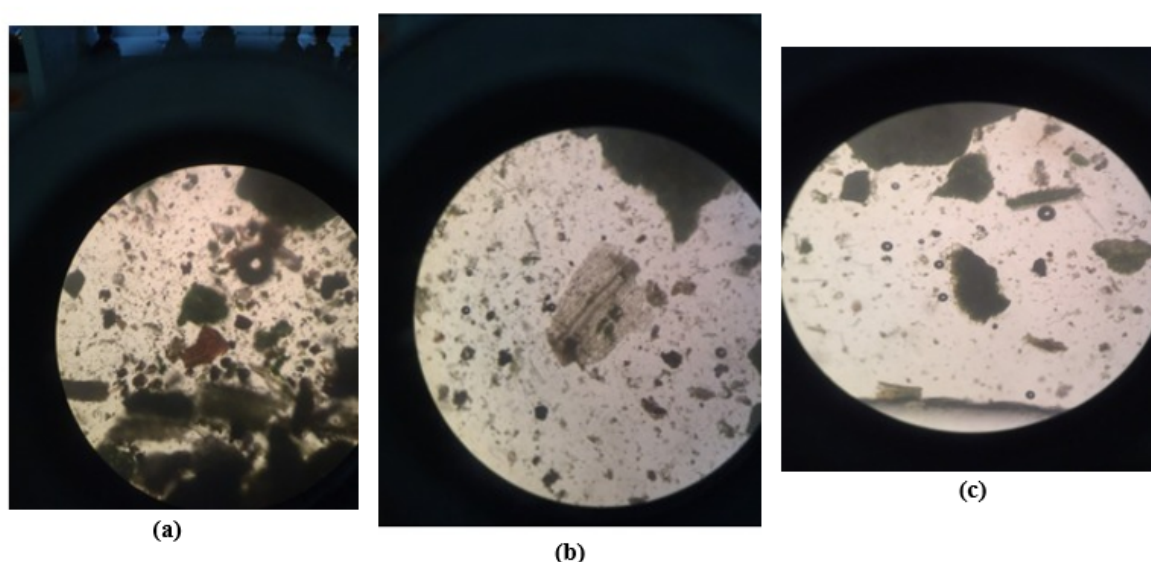


Fig. 2. Microscopic features of *Staurogyne elongata* raw material powder at 100 $\times$ magnification with chloral hydrate reagent: (a) oil cells; (b) sclerenchyma fibers; (c) cortical parenchyma fragments.

Table 2. Physicochemical characterization parameters of Reundeu (*Staurogyne elongata*) herb raw material.

Parameter	Result (Mean $\pm$ SD)
Moisture Content	$4.31\% \pm 0.5$
Total Ash Content	$24.48\% \pm 0.93$
Water-Soluble Ash	$5.5\% \pm 0.2$
Acid-Insoluble Ash	$21.4\% \pm 0.2$
Water-Soluble Extractable Matter	$34.36\% \pm 0.88$
Ethanol-Soluble Extractable Matter	$12.30\% \pm 0.43$

3.4. Phytochemical Screening

The results of qualitative phytochemical screening for both the raw material and ethanolic extract of *S. elongata* are presented in Table 3. Positive reactions were obtained for polyphenols, flavonoids, quinones, monoterpenoid-sesquiterpenoid compounds, and triterpenoids in both samples, whereas alkaloids, tannins, saponins, and steroids were absent from both samples.

Flavonoids were indicated by a development of yellow-to-orange color in the amyl alcohol layer after treatment with magnesium powder and hydrochloric acid, while a dark blue-black color following ferric chloride addition signaled the presence of polyphenols. A yellow-brown color with potassium hydroxide pointed to quinones [1], while a green color upon exposure to the Liebermann-Burchard reagent confirmed the presence of triterpenoids.

Table 3. Phytochemical screening results of *Staurogyne elongata* herb.

Secondary Metabolite	Raw Material	Ethanolic Extract
Alkaloids	–	–
Flavonoids	+	+
Tannins	–	–
Polyphenols	+	+
Quinones	+	+
Saponins	–	–
Monoterpenoids and Sesquiterpenoids	+	+
Steroids	–	–
Triterpenoids	+	+

Note: + = detected; – = not detected.

3.5. TLC Profiling of Polyphenols and Flavonoids

When the ethanolic extract was subjected to TLC on silica gel GF₂₅₄ using methanol:chloroform (3:7) as the mobile phase, a prominent spot appeared at $R_f = 0.92$, visible as a dark spot under 254 nm UV light and as a bright blue-green fluorescent spot at 365 nm (Fig. 3). Detection with citroborate reagent showed no color change at this R_f , a pattern broadly consistent with flavonoid-class compounds [13]. In the absence of co-chromatography against authentic reference standards (e.g., quercetin or rutin), the resolved spot is more cautiously described as a flavonoid-like compound rather than assigned to a specific flavonoid subclass such as flavonols. This identification should be regarded as tentative pending confirmatory analysis. Detection with FeCl₃ reagent also did not produce visible color change under daylight [16].

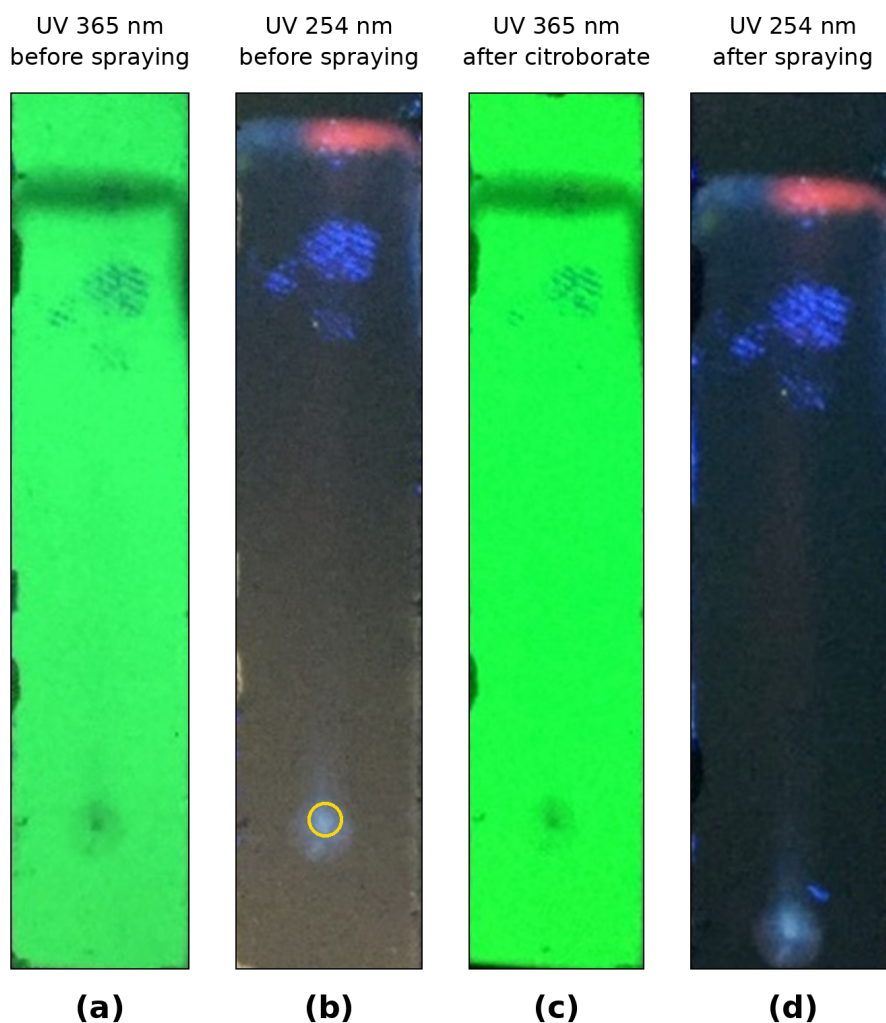


Fig. 3. TLC profile of ethanolic extract of *S. elongata* (mobile phase: methanol:chloroform 3:7): (a) UV 365 nm before spraying; (b) UV 254 nm before spraying; (c) UV 365 nm after citroborate spraying; (d) UV 254 nm after spraying.

3.6. Total Polyphenol Content

The gallic acid calibration curve displayed strong linearity ($y = 0.0319x + 0.1197$, $r = 0.9903$) over the 4–9 $\mu\text{g/mL}$ range at 764.8 nm. The results for the total polyphenol content of the ethanolic extract of *S. elongata* are presented in Table 4.

Table 4. Total polyphenol content of ethanolic extract of *Staurogyne elongata*.

TPC Replicate (mg GAE/g)	Mean TPC $\pm$ SD (mg GAE/g)
39.08	37.98 ± 0.98
37.66	
37.19	

The mean TPC was 37.98 ± 0.98 mg GAE/g dry extract, a value that falls within the range reported for other medicinal plants belonging to the Acanthaceae family. This aligns with Gangaram et al. [4], who reported that phenolic and flavonoid constituents are broadly recognized as major bioactive secondary metabolites across genera within the Acanthaceae family. The use

of gallic acid as the standard is well-justified, as it represents a stable and pure phenolic standard with high commercial availability [11,17]. Although the FC method is not entirely specific to polyphenols due to potential interference from non-phenolic reducing agents [11], it remains the most widely accepted and standardized method for comparative TPC assessment in plant extracts. Based on the triplicate determinations, the 95% confidence interval for TPC was approximately 35.5–40.4 mg GAE/g ($\text{mean} \pm t_{0.025,2} \cdot \text{SD}/\sqrt{n}$), giving an indication of the precision of this estimate (coefficient of variation 2.6%) alongside the reported standard deviation. A formal inferential comparison against literature values was not performed because the available reports for other Acanthaceae species do not share a common extraction protocol, precluding a like-for-like statistical test. Several factors may plausibly account for the specific TPC value obtained. The use of high-concentration (96%) ethanol as the extraction solvent likely favored co-extraction of both moderately polar phenolic acids and less polar flavonoid aglycones relative to a purely aqueous or low-ethanol system, a solvent-polarity effect widely reported for phenolic extraction. Interspecies and even intraspecies variation in TPC within Acanthaceae has also been attributed less to phylogeny per se than to differences in genotype, plant part sampled, and post-harvest handling [6]. In addition, environmental variables at the collection site — including light exposure, soil mineral status, and harvest season — are established modulators of phenylpropanoid-pathway flux and could further explain the specific value measured here, although these variables were fixed rather than systematically varied in the present single-site, single-season design. Mechanistically, the polyphenol and flavonoid pool detected by phytochemical screening is most plausibly generated through the phenylpropanoid pathway, in which phenylalanine is channeled toward cinnamic acid derivatives and subsequently toward flavonoids via chalcone synthase. However, confirming this pathway's specific activity in *S. elongata* would require targeted transcriptomic or enzymatic work that falls outside the descriptive scope of the present study and is proposed as a direction for future research.

3.7. Total Flavonoid Content

For quercetin, the calibration curve similarly showed excellent linearity ($y = 0.0032x + 0.0086$, $r = 0.9973$) over 50–100 $\mu\text{g/mL}$ at 434.5 nm, with the resulting total flavonoid content of the ethanolic extract presented in Table 5.

Table 5. Total flavonoid content of ethanolic extract of *Staurogyne elongata*.

TFC Replicate (% w/w QE)	Mean TFC $\pm$ SD (% w/w QE)
6.62	7.01 $\pm$ 0.40
6.98	
7.43	

The mean TFC was $7.01 \pm 0.40\%$ w/w quercetin equivalent (equivalent to 70 mg QE/g). It is important to note that TPC (37.98 mg GAE/g) and TFC (7.01% w/w QE) are expressed in fundamentally different units derived from different standard reference compounds and different analytical methods. Consequently, these values are not directly comparable numerically. Descriptively, TFC represents the flavonoid fraction, which constitutes a structural subclass within the broader polyphenol pool. This relationship is scientifically expected because the polyphenol pool additionally encompasses phenolic acids, quinones, terpenoid phenolics, and other non-flavonoid phenolic structures that contribute to the FC reaction but not to the AlCl_3 assay [6,7]. The AlCl_3 method specifically detects flavones and flavonols through stable chelate complexation at C-4 keto groups and adjacent C-3 or C-5 hydroxyl groups [12,13]. The presence of quinones and terpenoids confirmed by phytochemical screening further supports the existence of non-flavonoid contributors to the total polyphenol pool. As with TPC, the 95% confidence interval for TFC (approximately 6.0–8.0% w/w QE, derived from the triplicate mean and corrected SD; coefficient of variation, 5.8%) is reported to convey estimated precision. A formal statistical comparison against literature TFC values was similarly not attempted given the heterogeneity of extraction and calibration conditions across published studies.

3.8. Comparison with Related Studies

The present TPC value falls within the 18–42 mg GAE/g range documented by Matos et al. [3] for ethanolic extracts across several Acanthaceae species. In a taxonomically close relative, *H. colorata*, Devasahayam Arokia Balaya et al. [19] linked wound-healing and anti-inflammatory properties to polyphenolic content, underscoring why quantified phenolic reference values for related species are useful, although no such activity was assessed in the present study. A comparable association between antioxidant capacity and polyphenol content within Acanthaceae has also been noted by Balogun et al. [20]. Meanwhile, Rudrapal et al. [7] pointed out that TPC values fluctuate considerably across medicinal plant species depending on species identity, growing conditions, plant part analyzed, and extraction approach. Given this variability, the comparatively elevated polyphenol content measured in *S. elongata* extract provides a useful species-specific chemical reference point; whether this chemical richness translates into functional bioactivity was not tested here and remains to be established in dedicated assays.

Comparable TPC and TFC values have also been reported for other medicinal species assessed using similar colorimetric assays: Larit et al. [21] documented total phenolic and flavonoid contents alongside antioxidant activity in extracts and isolated compounds of *Cytisus villosus*, while Phuyal et al. [22] quantified total phenolic and flavonoid contents together with antioxidant activity across fruit, seed, and bark extracts of *Zanthoxylum armatum*. Similarly, Mehmood et al. [23] evaluated total phenolic and flavonoid contents alongside antioxidant and

antibacterial activities across a panel of medicinal plants using different solvent systems, reinforcing that solvent choice materially influences polyphenol and flavonoid yield obtained. Within the Acanthaceae family specifically, a phytochemical profile has also been reported for *Hemigraphis colorata* [24], a taxonomically close relative of *S. elongata*, further situating the present TPC and TFC values within a family-level context. Because comparative interpretation of TPC and TFC values across studies depends heavily on methodological consistency, ongoing editorial calls for the standardization of analytical methods in herbal drug research [25] remain directly relevant to positioning the present reference values within the broader literature.

Beyond chemical characterization, polyphenol- and flavonoid-rich extracts have been translated into applied formulations elsewhere, such as an antioxidant emulgel developed from *Centella asiatica* and *Moringa oleifera* leaf extracts [26], illustrating one plausible downstream application once the bioactivity of Reundeu extract is confirmed. The broader relevance of antioxidants across food applications, chemistry, and regulatory considerations has been extensively reviewed [27]. Beyond the present scope, related literature has also examined specific flavonoid bioactivities [28] and other antioxidant natural products, such as chitosan [29], although these applications were not evaluated in this study. Mechanistic insight into flavonoid biosynthesis within the Acanthaceae family has been provided by transcriptome and metabolome profiling of *Acanthus ilicifolius* [30], a line of investigation that could similarly illuminate the biosynthetic basis of the flavonoid pool detected in *S. elongata*. Within the same genus, alcoholic extracts of *Acanthus ilicifolius* have shown protective effects against atherogenic changes in a Wistar rat model [31], while antioxidant activity has also been reported for *Citrus sinensis* peel extracts rich in phenolic compounds [32]. Both findings reinforce the plausibility that the phenolic and flavonoid content quantified here may translate into measurable bioactivity in future assays. Broader links between plant bioactive compounds and other physiological systems, such as gut microbiota modulation [33], lie outside the present scope. Consistent quality control of herbal medicinal products more generally continues to be emphasized in the literature [34], and the structural and functional diversity of bioactive phytochemicals has similarly been surveyed within other plant families, such as Asteraceae [35]. Comprehensive reviews continue to describe the pharmaceutical and medical relevance of flavonoids and related phenolic compounds [36], while the broader medicinal potential of plant-derived bioactive compounds has recently been summarized [37]. Methodologically, the maceration-based extraction protocol applied in this study aligns with established techniques for recovering bioactive compounds from plant materials [38]. Within the Acanthaceae family, methanol extract and essential oil of *Acanthus polystachyus* have been shown to possess phytochemical, antioxidant, antimicrobial, antibiofilm, and antiquorum-

sensing potential [39], further supporting the pharmacological promise associated with this family and reinforcing the rationale for future bioactivity studies on *S. elongata*.

3.9. Limitations

A degree of caution is warranted when interpreting these results: the FC assay can be confounded by non-phenolic reducing agents, and the AlCl_3 method captures only flavones and flavonols, leaving other subclasses (e.g., flavanones, isoflavones, anthocyanins) undetected [12]. In addition, no antioxidant assays or compound-level structural elucidation (e.g., via HPLC-DAD or LC-MS/MS) were undertaken in this work. Addressing these gaps in subsequent studies would allow a more complete characterization of the bioactive potential of *S. elongata*.

4. Conclusions

This study confirms that *Staurogyne elongata* (Reundeu herb) harbors a diverse array of secondary metabolites, including polyphenols, flavonoids, quinones, monoterpenoid-sesquiterpenoid compounds, and triterpenoids. Its ethanolic extract yielded a TPC of 37.98 ± 0.98 mg GAE/g alongside a TFC of $7.01 \pm 0.40\%$ w/w quercetin equivalent (approximately 70 mg QE/g); each value is presented in its respective reference-standard unit, reflecting the compositional link between the overall polyphenol pool and the flavonoid subclass nested within it. The raw material further met Indonesian pharmacopoeial quality benchmarks for physicochemical characteristics. It should be emphasized that these findings establish only chemical characterization data, namely secondary-metabolite screening, TPC, and TFC, and do not by themselves constitute evidence of antioxidant, antibacterial, anti-inflammatory, or other biological activity, nor of efficacy or safety; any such claims would require dedicated bioassays that fall outside the present scope. Accordingly, rather than asserting readiness for development as a standardized herbal medicine, this study is best positioned as providing a foundational phytochemical and pharmacognostic reference dataset for Reundeu raw material and extract, upon which future antioxidant, chromatographic, and biological-activity studies can be built to substantiate its traditional medicinal use.

Abbreviations

TPC	Total Polyphenol Content;
TFC	Total Flavonoid Content;
FC	Folin-Ciocalteu;
AlCl_3	Aluminum Chloride;
GAE	Gallic Acid Equivalent;
QE	Quercetin Equivalent;
TLC	Thin-Layer Chromatography;
Rf	Retardation Factor;
MMI	Materia Medica Indonesia;
LIPI	Indonesian Institute of Sciences;

UV Ultraviolet;
SD Standard Deviation.

Data Availability Statement

Data will be made available on request from the corresponding author.

CRedit Authorship Contribution Statement

Fahrauk Faramayuda: Conceptualization, Methodology, Data Curation, Writing—Original Draft Preparation; **Ghea Rimanurfalah:** Investigation; **Ari Sri Windyaswari:** Supervision, Writing—Reviewing and Editing, Validation.

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.

Declaration of Use of AI in the Writing Process

The authors have verified the accuracy and scientific validity of all content, data, and conclusions presented herein. Generative AI tools were not used in the preparation of this manuscript.

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