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# Phytochemical Screening, Proximate and Mineral Constituents of *Triumfetta rhomboidea* Leaves and Roots

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**Abstract:** This study investigated the proximate, mineral constituents and qualitative phytochemical screening of both aqueous and ethanolic extracts of *Triumfetta rhomboidea* leaves and roots. The study involved the collection of samples from Ekiti State University farm, Ado Ekiti, Ekiti State, Nigeria. The samples were analyzed using standard analytical methods. Proximate analysis revealed that the leaves and roots of *Triumfetta rhomboidea* contained moisture (15.8 ±0.0, 15.2 ±0.1), crude protein (14.2 ±0.1, 10.2 ±0.0), crude fat (2.10 ±0.02, 0.92 ±0.04), ash (16.2 ±0.0, 12.2 ±0.1), crude fibre (9.14 ±0.04, 10.3 ±0.2), carbohydrate (42.6 ±0.1, 51.2 ±0.4) and energy (246, 254) content respectively. In addition, Na (44.7 ±0.2, 28.7 ±0.6), K (1203 ±3, 723 ±3), Mg (83.8 ±1.4, 41.2 ±0.3), P (896 ±4, 692 ±3), Ca (403 ±2, 294 ±2), Zn (11.0 ±0.1, 14.3 ±0.1), Mn (4.12 ±0.11, 2.92 ±0.06), Cu (2.42 ±0.02, 1.73 ±0.03, Cr (0.015 ±0.005, 0.045 ±0.005), were found in TRL and TRR while Cd and Pb were not detected in both samples. The phytochemical study showed that both aqueous and ethanolic extracts of *Triumfetta rhomboidea* leaves and roots contained phenols, tannins, flavonoids, and, reducing sugars. However, terpenoids were absent in both aqueous and ethanolic extracts of leaves and roots of *Triumfetta rhomboidea*. Alkaloids and steroids were present in the aqueous and ethanolic extract of roots only. Terpenoids were absent in both aqueous and ethanolic extracts of leaves and roots respectively with saponins not found in the ethanolic extract of the leaves only. Cardiac glycosides and phlobatannins were identified in both aqueous and ethanolic extracts of leaves only. These findings suggest that *Triumfetta rhomboidea* leaves and roots may have potential health benefits and could be used as natural sources of important nutrients and phytochemicals. The plant parts considered in the present study can be very useful in the development of either therapeutic or prophylactic medicine and can also be good sources of supplements in foods. Further research is needed to fully understand the potential benefits of *Triumfetta rhomboidea* and its components in different contexts.

**Key words:** *Triumfetta rhomboidea,* leaves, roots, proximate, minerals, phytochemicals

## I. Introduction

The search for natural remedies has been a topic of great interest in recent years. Medicinal plants have been used by different cultures as a primary source of medicine and food for centuries [1]. Medicine developed from natural plants is commonly used due to its eco-friendliness, ease of accessibility, economic viability and generation of little or no side effect [2],[3]. Different parts of medicinal plants are targeted for investigation and these include leaves, roots, fruits, stems, barks, flowers, transudate and exudate [2],[4]. Therefore, any part with therapeutic and prophylactic effects are mostly used as alternative medicines for the prevention, management and treatment of diseases such as ulcer, diabetes, hypertension, and obesity own to their safety, ease of accessibility and efficiency. The health benefits and effectiveness of medicinal plants in ethnomedical practices have propelled scientific researchers to explore their biochemical compositions and functions in both the prophylactic and therapeutic treatment of sicknesses [5]. Usually, phytochemicals are organic and they exercise akin physiological actions comparative to manmade medicines. Therefore, they are frequently employed as important sources of pharmaceutical ingredients and lead compounds in food manufacturing companies [3],[6]. Bioactive compounds that commonly possess both therapeutic and prophylactic properties include saponins, flavonoids, tannins, steroids, glycosides, phenols, alkaloids, phlobatannins and terpenoids [7],[8]. The mentioned bioactive compounds have been reported to possess mitigating potential of oxidative stress in ulcer, diabetes, neurodegenerative disorder, inflammation, cardiovascular diseases and allergic response [9]. It was reported that there were over 250,000 medicinal plant species out of which 21,000 were enlisted in [10]. *Triumfetta rhomboidea* (*T. rhomboidea)* was among the un-noticed medicinal plants [11].

*T. rhomboidea* of the *Tiliaceae* family is an herbaceous perennial and pantropical plant. It is an under shrub, widely distributed in tropical and subtropical India, Ceylon, Malay Peninsula China, Africa and America [12],[13]. *T. rhomboidea* is popularly known as Chinese purr bur weed in English language and vernacularly known as ako bolo bolo, and ilasa omode in Yoruba land. It is called udo in Igbo and yanka-dafi in Hausa [14],[15]. Reports revealed various use of its different parts (leaves, roots, flowers, bark and stem) in diverse parts of the globe. Traditionally, all these parts have been implicated in the treatment of numerous diseases such

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as dysentery, intestinal ulcer, boils, inflammation, diarrhea and gonorrhea. In addition, the pounded stem and leaves are used as a poultice for tumours and urinary diseases [16], [17] .

The *T. rhomboidea* leaf was reportedly used as infusions for children to prevent fever, diarrhea, and dysentery in Côte d'Ivoire and Burkina Faso [14]. People in Rwanda use the leaf as therapy for treating pneumonia and snakebites. Pregnant women in South Africa and Uganda usually consumed the plant decoction to hasting and making childbirth easy. It is used also as veterinary medicine in the treatment of worms and digestive disorder in Nigeria [3]. There have been reports on the phytoconstituents, proximate components, antioxidants and medicinal properties of *T. rhomboidea* but little or no report has been on the nutritional composition of the leaves and roots of this valuable plant. Therefore, this study investigated the mineral, phytochemical and proximate composition of *T. rhomboidea* leaves and roots.

## II. Materials and Method

### Collection of Plant Material

*T. rhomboidea* plant was collected from Ekiti State University farm, Ado Ekiti, Ekiti State, Nigeria. The plant identification was authenticated by Mr Felix Omotayo, at the Herbarium in the Department of Plant Science and Biotechnology, Ekiti State University, Ado Ekiti. A voucher specimen no (UHAE 2019158) was deposited at the Herbarium.

### Sample Preparation

*T. rhomboidea* leaves were separated from the whole plant, rinsed with distilled water and air- dried for two weeks. Also, the detached plant roots were thoroughly washed in water to remove adhered debris and soil particles and later rinsed with distilled water. The cleaned root part was cut into tiny pieces and air-dried for two weeks. The air-dried samples were turned into powdery form by using a Marlex blender. Powdered samples were kept in a sealed container for further analysis.

### Proximate composition

Proximate composition of the samples which include moisture, crude protein, crude fat, crude fibre, and ash was analyzed by using the procedures described by Onwuka (2005) [18]. Moisture content was determined by drying the sample to a constant weight in the oven at 105$^{o}$C. Crude protein content was determined by estimating the nitrogen content using the Kjedahl method of analysis. Ash content was determined by incineration of the sample at 550$^{o}$C in a furnace. The Soxhlet extraction method was used for the determination of crude fat, while the crude fibre was assayed by acid and alkali digestion. Carbohydrate content was calculated by difference as shown below:

% Carbohydrate = 100 – (% Protein + % Moisture + % Fat + % Fibre + % Ash)

The energy value (kcal/100g) of the samples was calculated by multiplying the crude protein value by 4, carbohydrate content by 4 and the crude fat value by 9. Samples were analyzed in duplicates.

### Mineral Analysis

1g of the sample's ash was digested by using 10% $HNO_3$. It was filtered, and the filtrate was made up to the mark (100ml) with distilled water. The concentration of magnesium, calcium, zinc, manganese, copper, chromium, cadmium and lead were determined with Atomic Absorption Spectrometer (Bulk Scientific, East Norwalk, CT, USA), while sodium and potassium were determined with a flame photometer (Corning, UK Model 405)[19]. The vanadomolybdate colorimetric method was used for the determination of the concentration of phosphorus by using an advanced UV/Visible Spectrophotometer [20] .

### Phytochemical Screening

The plant extracts used for phytochemical analysis were prepared by using ethanolic and aqueous extraction as described by Nagappan (2012)[21] with slight modification. 50 g of powdered plant material was kept in 500 ml conical flask and 200 ml of solvent (water or ethanol) was added. The mouth of the conical flask was covered with aluminum foil and kept in a shaker for 24 h for continuous agitation and thorough mixing. Thereafter, the extract was filtered by using muslin cloth followed by Whatman no 1 filter paper and finally filtered by using a vacuum and pressure pump. The solvent from the extract was removed by using Stuart rotary evaporator RE300 with a water bath temperature of 50 $^{o}$C. Finally, the residue was collected and used for the experiment.

Test for alkaloids, flavonoids, cardiac glycosides and reducing sugar was carried out by using the procedure reported by Prashanth and Krishnaiah [22]; while tests for tannins, saponins, phenols and steroids were determined by using the method described by Firdouse and Alam [23]. The presence of phlobatannins and terpenoids was tested as described by Solihah et al. [24].

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## III. Results and Discussion

### Results

The result in Table 1.1 reveals the amount of moisture (15.8 ±0.0, 15.2 ±0.1), crude protein (14.2 ±0.1, 10.2 ±0.0), crude fat (2.10 ±0.02, 0.92 ±0.04), ash (16.2 ±0.0, 12.2 ±0.1), crude fibre (9.14 ±0.04, 10.3 ±0.2), carbohydrate (42.6 ±0.1, 51.2 ±0.4) and energy (246, 254) content present in TRL and TRR respectively.

Table 1.1: Proximate composition (%) and energy value (kcal/100g) of *T. rhomboidea* leaves and roots

| Parameters | TRL | TRR |
|---|---|---|
| Moisture | 15.8 ±0.0 | 15.2 ±0.1 |
| Crude Protein | 14.2 ±0.1 | 10.2 ±0.0 |
| Crude Fat | 2.10 ±0.02 | 0.92 ±0.04 |
| Ash | 16.2 ±0.0 | 12.2 ±0.1 |
| Crude Fibre | 9.14 ±0.04 | 10.3 ±0.2 |
| Carbohydrate | 42.6 ±0.1 | 51.2 ±0.4 |
| Energy | 246 | 254 |

TRL- *Triumfetta rhomboidea* leaves, TRR- *Triumfetta rhomboidea* roots

Table 2.1 shows that TRL and TRR respectively contained, 44.7 ±0.2 and 28.7 ±0.6 Na, 1203 ±3 and 723 ±3 K, 83.8 ±1.4 and 41.2 ±0.3 Mg, 896 ±4 and 692 ±3 P, 403 ±2 and 294 ±2 Ca, 11.0 ±0.1 and 14.3 ±0.1 Zn, 4.12 ±0.11 and 2.92 ±0.0 Mn, (2.42 ±0.02 and 1.73 ±0.03 Cu, 0.015 ±0.005 and 0.045 ±0.005 Cr but Cd and Pb were absent in that order as well.

Table 2.1: Mineral contents of *Triumfetta rhomboidea* leaves and roots

| Minerals | TRL | TRR |
|---|---|---|
| Sodium (Na) | 44.7 ±0.2 | 28.7 ±0.6 |
| Potassium (K) | 1203 ±3 | 723 ±3 |
| Magnesium (Mg) | 83.8 ±1.4 | 41.2 ±0.3 |
| Phosphorus (P) | 896 ±4 | 692 ±3 |
| Calcium (Ca) | 403 ±2 | 294 ±2 |
| Zinc (Zn) | 11.0 ±0.1 | 14.3 ±0.1 |
| Manganese (Mn) | 4.12 ±0.11 | 2.92 ±0.06 |
| Copper (Cu) | 2.42 ±0.02 | 1.73 ±0.03 |
| Chromium (Cr) | 0.015 ±0.005 | 0.045 ±0.005 |
| Cadmium (Cd) | ND | ND |
| Lead (Pb) | ND | ND |

TRL- *Triumfetta rhomboidea* leaves, TRR- *Triumfetta rhomboidea* roots **ND**- Not Detected

Table 3.1 shows that there is presence of phenols, saponins, flavonoids and reducing sugars in aqueous extracts of both TRL and TRR while alkaloids, and steroids with terpenoids and cardiac glycosides were absent in TRL and TRR respectively. In addition, Table 3.2 reveals that the ethanolic extracts of TRL and TRR contained alkaloids, tannins, phenols, flavonoids and reducing sugars while saponins and terpenoids were absent in both. Cardiac glycosides and phlobatannins were found in TRL only with steroids identified in TRR only.

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Table 3.1: Qualitative phytoconstituents screening of aqueous extract of *T rhomboidea* leaves and roots

| Phytochemicals | TRL | TRR |
|---|---|---|
| Alkaloids | _ | + |
| Tannins | + | _ |
| Phenols | + | + |
| Saponins | + | + |
| Flavonoids | + | + |
| Cardiac glycosides | + | _ |
| Steroids | _ | + |
| Reducing sugars | + | + |
| Terpenoids | _ | _ |
| Phlobatannins | + | _ |

TRL- *Triumfetta rhomboidea* leaves, TRR- *Triumfetta rhomboidea* roots, "+"- Present, "-"- Absent

Table 3.2: Qualitative phytochemical screening result of ethanolic extract of *Triumfetta rhomboidea* leaves and roots

| Phytochemicals | TRL | TRR |
|---|---|---|
| Alkaloids | + | + |
| Tannins | + | + |
| Phenols | + | + |
| Saponins | - | - |
| Flavonoids | + | + |
| Cardiac glycosides | + | - |
| Steroids | - | + |
| Reducing sugars | + | + |
| Terpenoids | - | - |
| Phlobatannins | + | - |

TRL- *Triumfetta rhomboidea* leaves, TRR- *Triumfetta rhomboidea* roots, "+"- Present, "-"- Absent

**Discussion**

Results obtained in this study (Table 1.1) could be an indication that TRL and TRR are good sources of carbohydrates. Nonetheless, the carbohydrate content of TRR was higher than that of TRL. However, it was observed from the result of the analysis that the carbohydrate content of TRL found in our current study was lower compared to the result of [3]. Climatic conditions might be a responsible factor. Low fat level was observed in both samples analysed in this study which implies that the leaves and roots of *T. rhomboidea* will not promote excess weight gain when consumed. There are variations in the moisture contents of foods and water is a major constituent of most food products as reported in the literature [25]. TRL and TRR moisture content in this study is shown above (Table 1.1). Studies have shown that moisture is an essential factor in food quality, resistance to deterioration and preservation. Calculation of the content of other food constituents on a uniform basis (i.e. dry weight basis) depends on the determination of moisture contents [8]. The ash content (16.2 ±0.0 and 12.2 ± 0.1 TRL and TRR respectively) is an indication that TRL and TRR contain some amounts of mineral. Since ash content has been revealed as the crude pointer for minerals [26]. Crude fibre content (9.14 ± 0.04 and 10.30 ± 0.2) of TRL and TRR in that order is substantial. Fibre is known to help in cleansing the digestive tract of its consumer and hinders the absorption of excess cholesterol. Fibre has also been reported to add bulkiness to the

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stomach (food) and prevents the intake of too much starchy food which can thus guide against metabolic conditions like diabetes mellitus and hypercholesterolemia [27][28] . This result was at variance with the result of Akintimehin *et al.* [3] which might peradventure be due to differences in climatic conditions and the fact that the chemical composition of most herbs changes with geographical location which may be associated with diverse climatic conditions and biochemical variations.

The mineral constituents of TRL and TRR are displayed in Table 2.1 and from these results, it was discovered that they have a high content of K (1203 ±3, 723 ±3); P (896 ±4, 692 ±3); Ca (403 ±2, 294 ±2); Mg (83.8 ±1.4, 41.2 ±0.3); Na (44.7 ±0.2, 28.7 ±0.6); Zn (11.0 ±0.1, 14.3 ±0.1), moderate contents of Mn (4.12 ±0.11, 2.92 ±0.06); Cu (2.42 ±0.02, 1.73 ±0.03) and very low components of Cr (0.015 ±0.005, 0.045 ±0.005). Cd and Pb were not detected in both TRL and TRR. The leaves and roots of this plant could be very vital in maintaining electrolyte balance and membrane fluidity, level of blood glucose and strong bone, reducing blood pressure, blood clotting, muscle contraction and relaxation, and help in haemoglobin formation [8],[29] ;. Some researchers [30],[31], [32] in their studies have reported that potassium might prevent or slow down the progression of renal disease, reduce urinary calcium excretion, and function vitally in the management of kidney stones and hypercalciuria. They reported further that it could likely lower the risk of osteoporosis and the development of diabetes associated with prolonged use of thiazide diuretics. In sum, potassium and magnesium have been found to reduce blood pressure, and potassium also functions in controlling skeletal muscle contraction and nerve impulse transmission [33]. Phosphorus is one of the vital elements in the body and is needed for various processes such as bone mineralization, ATP synthesis, and signal transduction. The compound of this element has been implicated indirectly in the prevention of rickets and osteomalacia [34]. Research findings showed that calcium is the major element sustaining strong bones and plays a strong role in muscle contraction and relaxation, blood clotting and absorption of vitamin B12 [8]. High calcium and potassium are usually recommended for patients with strong bone problems and calcium was found to be crucial for blood clotting and as a co-factor in some enzyme catalysis [31]. Diverse minerals present in plants are also co-enzymes in certain biochemical reactions thus, plants are very important in metabolic reactions.

The presence of phenols, flavonoids, tannins and reducing sugars in the extracts of both leaves and roots of *T. rhomboidea* (Table 3.1 and 3.2) shows the antioxidant properties since phenolic compounds have been reported to have many biological effects such as antioxidant, anti-carcinogenic and anti-inflammatory[35], [36]. Therefore, plants containing phenols might be potent in the development of medicine for the prevention or/ and treatment of numerous chronic diseases including diabetes, cardiovascular diseases, cancer, ulcer, parasitic and bacterial infections [37]. Similarly, flavonoids possess antioxidant property also in that they can inhibit oxidant enzymes such as xanthine oxidase, nitric oxide synthase and peroxidases. These enzymes have been implicated in the production of free radicals and thereby causing a decrease in oxidative macromolecular damage [38]. Furthermore, flavonoids have antioxidant activity due to their ability to scavenge superoxide anions, lipid peroxy radicals and hydroxyl radicals [8]. Tannins were reported in the literature to inhibit the growth of microorganisms through precipitation of the microbial proteins thus making unavailable nutritional proteins for the microorganisms. This was achieved by binding tannins to proteins and inhibiting protein synthesis [8][9]. In addition, tannins have been shown to have inhibitory potential over the growth of numerous yeast, bacteria, fungi and viruses [29]. Thus, they have various physiological impacts like antiphlogistic, anti-irritant, anti-parasitic and antimicrobial effects which enhance the usefulness of tannins containing plants such as *T. rhomboidea, C. longa, A. racemose* and *A. maginata* in the treatment of inflammations of the mouth, non-specific diarrhea, slightly injured skin, fever, cough, and rheumatism [39][40] .

It was discovered from literatures that saponins show lipid-lowering, anti-fungal, anti-protozoal and antibacterial effects [41] . Therefore, the presence of saponins in the aqueous extract of TRL and TRR shows that they can be used as lipid lowering agent, as well and they possess anthelmintic and antibacterial activity. Furthermore, they can be used as cytotoxic and cough medicine through the stimulation of a reflex of the upper digestive tract [36],[42] . However, ethanolic extracts of TRL and TRR might be impotent in producing all the medicinal values due to the absence of saponins in the extracts. Moreover, both extracts might have reductive properties in that they both contain reducing sugar [43]. Reducing sugars have been reported to lower significantly dental cavities. They also tend to lower the risk of getting diabetes and the chance of being overweight and obese [44] (WHO, 2015). Thus, TRL and TRR might have potential health benefits and can be used as a supplement in diets and in the development of medicine for the above-mentioned diseases.

## IV. Conclusion

This study provides valuable information on the phytochemical components, minerals, and proximate composition of *T. rhomboidea* leaves and roots. The results showed that *T. rhomboidea* is a rich source of alkaloids, flavonoids, tannins, saponins, potassium, phosphorus, calcium and magnesium. These findings suggest that *T. rhomboidea* may have potential health benefits and could be used as a natural source of important nutrients, development of medicine and supplement.

Further research is needed to fully understand the potential benefits of *T. rhomboidea* and its components in different contexts.

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