

Talinum Triangulare (Water Leaf): What a Wonderful Plant?

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Abstract

The importance of nutraceutical plants and the contribution of phytomedicine to the well-being of quite a large number of people and their animals worldwide has attracted interest from a variety of disciplines. Nutraceutical plants have proved to be very important in the medicinal plants research and because of the bioactive compounds that these plants possess, they are useful in drug research and development. This article reviewed the bioactive constituents of *Talinum triangulare*; its therapeutic and nutritional importance as well as the usefulness of its bioactive compounds in agricultural settings. Bioactive components such as alkaloids, flavonoids, saponins, tannins, phlobatannin, anthraquinones, steroid, terpenes, phenols, cardiac glycoside were reported to be present in *T. triangulare*. *T. triangulare* has been implicated medically in the management of cardiovascular diseases like stroke, obesity and this was attributed to the presence of some bioactive compounds such as flavonoids and antioxidants in this plant. *T. triangulare* was also reported to contain some important minerals such as β -carotene, minerals (such as calcium, potassium and magnesium), pectin, protein and vitamins. Investigations involved inclusion of *T. triangulare* dried powder as additive in the feed and inclusion of the leaf extract in drinking water were also reported to improve growth performance as well as immune system of both aquatic and terrestrial animals respectfully. It is therefore concluded that *T. triangulare* leaves can contribute significantly to the health management of Man and animal and should be recommended to be included in the daily nutritional requirement of both Man and animal.

Keywords: Nutraceutical plants; Bioactive compounds; *Talinum triangulare*; Health; Nutrition.

1. Introduction

Talinum triangulare (Tt) commonly known as water leaf, belongs to the plant family *Portulacaceae*, is an herbaceous, perennial, and glabrous plant widely grown in tropical regions as a leaf vegetable [1]. It has high moisture content of almost 90.8 g per 100 gm of edible leaf [2] hence popularly known as waterleaf. It is an erect perennial herb with swollen roots and succulent stems, 30-100 cm tall. The branches have two lateral basal buds. The leaves are spirally arranged to nearly opposite, often crowded at the top of the stem (Figure 1).

Figure-1. *Talinum triangulare* (Water leaf)



The waterleaf is fast growing and once established, easily reseeds itself. It flowers early year-round, and is mainly self-pollinating. The flowers are pink in colour and open in the morning. It thrives well under shade and in cloudy weather, spreads easily and is becoming an agricultural weed. Waterleaf is relatively tolerant to drought conditions as they tend to adopt a crassulacean acid metabolism (CAM) pathway, thus resulting in efficient utilization of available moisture, carbon dioxide assimilation during night and increased growth [2].

Talinum triangulare was introduced into South India from Sri Lanka [3] and is cultivated in Tamil Nadu as Ceylon Spinach for its edible leaves. The plant is widely grown in most of the humid tropical countries such as West Africa, Asia and South America [4]. It with its slimy texture, is a popular vegetable in many African countries and is popular in Nigeria among some tribes to make indigenous soups such as Gbure, Edikaiko and Afang in Yorubas, Ibibios and Efiks, respectively. It had been pointed out by Ezekwe, *et al.* [1] that Tt is rich in β -carotene, minerals (such as calcium, potassium and magnesium), pectin, protein and vitamins hence useful as vegetable soup.

In Nigeria and most West African countries, several vegetable species abound and they are used partly as condiments or spices in human diets or as supplementary feeds to livestock such as rabbits, poultry, swine and cattle [5]. Many research works had been carried out on the specific nutrients and phytochemicals of a large number of these native vegetable species within Nigeria and this supposed to give an insight to Nigeria populace on how to harness the potential benefits of these vegetable in management of health since it had been investigated and concluded by Ezekwe, *et al.* [6] that those vegetable abound around, more affordable, sometimes offer better therapeutic value than synthetic drugs and they are relatively safer. Nigeria is richly endowed with these varieties of vegetable however their benefits are not in most cases exploited beyond the traditional localities where they are found and consumed. This article reviews the phytochemical constituents, nutritional and medicinal potentials of Tt as reported in many scholar works with hope of giving useful information to the potential users of this plant.

2. The Phytochemical Constituents of *Talinum Triangulare*

Active biological components of vegetables and plants can be evaluated using phytochemical analysis. The phytochemical analysis of the Tt was carried out on fresh samples and dried samples according to the method of Harbourne [7] as reported by Ezekwe, *et al.* [6] and Sofowora [8]; and as also reported by Tiamiyu [9] (PhD thesis) respectively to identify its active constituents. The results of the phytochemistry indicate that the leaves contain bioactive components such as alkaloids, flavonoids, saponins, tannins, phlobatannin, anthraquinones, steroid, terpenes, phenols, cardiac glycoside as were indicated in Table 1 and 2 respectively. Some bioactive compounds were present in substantial amount, some are moderately present while some present in trace quantity. The plant extract was equally evaluated chemically in line with the official procedures of analysis styled by the association of official analytical chemist [10] 18TH Edition as reported by Tiamiyu [9] (PhD thesis) and the results were shown in Table 3. The presence of these bioactive compounds show high level of its possible medicinal and dietary values [11].

Table-1. The phytochemical composition of the fresh leaves of *Talinum triangulare*

S/N	Bioactive Compounds	Relative Abundance
1.	Flavonoids	+++
2.	Alkaloids	++
3.	Glycosides	++
4.	Saponins	+
5.	Steroids	++
6.	Proteins	+++
7.	Carbohydrates	+++
8.	Fats and Oil	+
9.	Tannins	+
10.	Resins	+++
11.	Terpenoids	+++
12.	Reducing sugars +	+

Observation Remarks:

+++ = Substantial Quantity Present,

++ = Moderate Quantity Present

+ = Trace Quantity Present

Source: - Ezekwe, *et al.* [6]

Table-2. The phytochemical composition of the dried leaves of *Talinum triangulare*

S/N	Bioactive Compounds	Relative Abundance
1.	Flavonoids	+
2.	Alkaloids	+++
3.	Cardiac glycoside	++
4	Saponin	+++
5	Steroids	+
6	Phlobatannin	+++
7	Chalcones	-
8	Cardenolides	-
9	Tannin pp	++
10	Terpenes	+
11	Anthraquinones	+
12	Phenol PPP	+++

Observation Remarks:

+++ = Substantial Quantity Present,

++ = Moderate Quantity Present

+ = Trace Quantity Present

- = Absolute absent

Source: - [Tiamiyu \[9\]](#) (PhD thesis)**Table-3.** Proximate analysis of *Talinum triangulare*

Moisture (%)	Fiber (%)	Fat (%)	Protein (%)	Ash (%)	Carbohydrate (%)
10.37	16.43	2.23	11.88	13.29	45.80

3. Medical and Health Importance of Bioactive Compounds of *Talinum Triangulare*

The presence of flavonoids as reported have shown that the **Tt** would be good for the management of cardiovascular diseases and oxidative stress, since flavonoids are biologic antioxidants [12]; and also have antitumor properties [12]. Antioxidants are compounds that protect cells against the damaging effects of reactive oxygen species, such as singlet oxygen, super oxide, peroxy radicals, hydroxyl radicals and peroxy nitrite. Cellular damage is a consequence of imbalance between antioxidants and reactive oxygen species which results in oxidative stress [13]. And more so, [Paloza \[14\]](#) explained that oxidative stresses have been linked to cancer, aging, atherosclerosis, inflammation, ischemic injury and neuro degenerative diseases (Parkinson's and Alzheimer's diseases). [Donald and Cristobal \[15\]](#), pointed out that several studies have shown that certain flavonoids can protect Low-density Lipoproteins (LDL) from being oxidized. The oxidation of LDL has been recognized to play an important role in atherosclerosis, immune system; cells macrophages recognize and engulf oxidized LDL, a process that leads to the formation of atherosclerotic plaques in the arterial wall.

Talinum triangulare has been also implicated medically in the management of cardiovascular diseases like stroke, obesity, etc. [16]. Traditionally, the leaves of water leaf had been reported to have been used to treat polyuria [17], internal heat, measles [18], gastrointestinal disorders [19], hepatic ailments and cancer [20]. [Monago and Uwakwe \[21\]](#) pointed out that dietary fibre present in **Tt** could decrease the absorption of cholesterol from the gut and thus functions in the protection against cardiovascular disease, colorectal cancer and obesity and it could also delay the digestion and conversion of starch into simple sugars, an important factor in the management of diabetes mellitus. In this case, the increased in fibre content of the cooked leaf of **Tt** as it was observed by [Ogbonnaya and Chinedum \[22\]](#) could be of benefit to people suffering from cardiovascular diseases, obesity, diabetes mellitus hence its usage in the traditional management of the diseases mentioned. Some bioactive compounds present in **Tt** are of health benefit to the consumers. Tannins is well known for its anti-oxidant and anti-microbial properties, as well as for soothing relief, skin regeneration, as anti-inflammatory and diuretics [23]. Some researchers [8, 24] reported that saponins have haemolytic activities and are cough suppressants as well as expectorants. It was equally reported to have ability to lower the cholesterol level and have anti-carcinogenic properties as well as anti-diabetic [25]. Terpenes or terpenoids have anti-hepatotoxic properties, thus helping to prevent liver damage (cirrhosis), they equally have anti-microbial or anti-septic properties), while cardiac glycoside acts on the heart muscles and increase renal flow (diuresis). Steroids regulate carbohydrate and protein metabolism, and possess anti-inflammatory properties as well. Phlobatannins on the other hand, have astringent properties. **Tt** could be important in the medicinal plants' research and because of the phytochemicals that it possess, it could be useful in drug research and development.

4. Nutritional Importance of *Talinum Triangulare*

Vegetables are important constituents of the human diet since they supply the body with vitamins, minerals, some hormone precursors as well as protein and energy [26]. The concentrations of some mineral present in **Tt** was evaluated by [Ujowundu, et al. \[27\]](#) and it was reported that **Tt** contains appreciable amount of Iron (Fe), Calcium (Ca), Copper (Cu) and Magnesium (Mg). The significance of these elements in **Tt** cannot be over emphasized.

Calcium, Magnesium and Phosphorous fall under macro-nutrients or the principal mineral elements and they form important constituents of the bones and teeth. [28] reported that iron plays an important role in many parts of the body, including energy metabolism, immune function, cognitive development, temperature regulation and work performance. Some iron rich foods are poor sources of the mineral because other compounds render it non-absorbable. The bioavailability of the iron present in a meal depends on its form and the presence or absence of factors that influence absorption [29]. Calcium ions are involved in blood clotting, nerve impulse transmission, muscle contraction [30]. However, a high calcium level in drinking water may slow iodine absorption resulting in goiter, particularly if the iodine level is borderline in meeting body needs. Magnesium is found in chlorophyll, therefore this could be reason why **Tt** green leafy vegetables are rich sources of Mg [29]. In an experiment carried out by Lucas, 1998, the ash content of the raw leaves of **Tt** fell within the acceptable range of edible vegetables in Nigeria [31]. It was also discovered that the decrease in the ash content was as result of cooking, which is a reflection of its total mineral content, and this may suggest that the conventional method of cooking the vegetable decreases its mineral content.

5. Agricultural Importance of *Talinum Triangulare*

Akachuku and Fawusi [32], investigated the crude protein content of fresh **Tt** leaves and tender stems and found it to be as high as 29.4% and 13.4% respectively. Sridhar and Lakshminarayana [33], also gave a report on high total lipids, essential oils and alpha-tocopherols and beta-tocopherols in *Talinum triangulare*. This information gave the clue that **Tt** could be used as source of protein in animal feed. Sanda [34] conducted an experiment to evaluate the effects of **Tt** extract on the growth performance and immune responses of broilers vaccinated with Newcastle Disease Vaccine (La Sota). The result showed that inclusion of water leaf extract in drinking water significantly ($p>0.05$) increased weight gain, final live weight and feed conversion efficiency of the broiler compared with the control and also improve the immune responses of broilers to Newcastle Disease virus. In another experiment carried out by Tiamiyu [35] on growth performance of African Catfish, *Clarias gariepinus*, fed varying inclusion levels of **Tt** as feed additives, he observed improve growth performance of treated fish compared with untreated fish (Table 4). Tiamiyu [9] also reported significant improve in PCV (%) and haemoglobin (Hb) concentration of African Catfish (*Clarias gariepinus*) fingerlings especially when 1.0% **Tt** dried powder was fed as feed additive. These aforementioned research works have shown that **Tt** is useful in aquaculture as well as in terrestrial animals.

Table-4. Growth performance of *Clarias gariepinus* fingerlings fed different concentration of *Talinum triangulare* as feed additives.

	0.0%	0.5%	1.0%	3.0%
Parameters				
MIBW ¹ (g)	1.07±0.240 ^a	1.05±0.029 ^a	1.10±0.015 ^a	1.09±0.049 ^a
MFBW ² (g)	1.91±0.127 ^b	2.14±0.084 ^b	2.38±0.096 ^b	1.86±0.439 ^b
AWG ³ (g)	0.84±0.107 ^a	1.09±0.113 ^a	1.28±0.085 ^a	0.87±0.110 ^a
RWG ⁴ (%)	78.9±8.87 ^a	104.9±13.63 ^a	116.3±6.82 ^a	97.9±5.69 ^a
SGR ⁵	0.36±0.029 ^a	0.44±0.043 ^a	0.48±0.019 ^a	0.42±0.017 ^a
FCR ⁶ (gg-1)	5.77±0.53 ^a	5.14±0.45 ^a	4.65±0.11 ^a	5.45±0.69 ^a
SR ⁷ (%)	75.00±4.81 ^a	83.34±8.33 ^a	80.56±7.35 ^a	75.00±4.78 ^a
CF ⁸ (K)	0.80±0.03 ^a	0.87±0.06 ^a	0.94±0.02 ^a	0.86±0.10 ^a

Note: Data are represented as mean of three samples replicates ± standard error. Mean values with the same superscript letter in the same row are not significantly different ($p>0.05$). ¹Mean Initial body weight, ²Mean Final Body Weight, ³Average Weight Gain, ⁴Relative Weight Gain, ⁵Specific Growth Rate, ⁶Feed Conversion Rate, ⁷Survival Rate, ⁸Condition Factor.

Source: - Tiamiyu [35]

6. Toxicity level of *Talinum Triangulare*

The amount of cyanide in plants are always taken into consideration when such plants are to be consumed since cyanogenic glucosides are present in most plants and the quantities available could make the plant to be either toxic, non-toxic or lethal when eaten bearing in mind that cyanide is an effective cytochrome oxidase inhibitor in the electron transport chain partway. The acceptance of dried powder of **Tt** in *Clarias gariepinus* fingerlings without negative consequences could be attributed to the processing technique of drying. Agricultural practices such as soaking, drying, frying and fermentation are employed to reduce toxicity of medicinal plants in animal feeds as these processes reduce the anti-nutritional factors in plant and thereby increase the palatability. The acceptability of **Tt** in the experimental animals and non-availability of report of its toxicity in Man and animal when consumed either in fresh and treated forms could mean that its cyanide content is lower than the lethal dose. Therefore, the leaves of **Tt** are safe for consumption with respect to cyanide content.

7. Conclusion

The consumption of *T. triangulare* by humans and animals will contribute to the maintenance of their overall health as evidenced by our discussions above. However, the pharmacological significance of the phytochemicals of the **Tt** needs to be studied; experimented on animal models and subsequent human clinical trial. Further studies are therefore, needed for the isolation and characterization of each phytochemical compounds and further test their efficacy on growth performance and usefulness to prevent and possibly control all diseases mentioned.

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