NUTRITIONAL COMPOSITION OF METHANOL EXTRACTS OF TALINUM TRIANGULARE (WATER LEAF) LEAVES AND STEM GROWN IN ENUGU, NIGERIA

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Abstract - The leaves and stems of Talinumtriangulare (Water leaf) is a vegetable consumed as a major part of meals and used in traditional medicinal practice for various ailments in Enugu, Nigeria. In this study the nutritional composition of Talinumtriangulare (Water leaf) leaves and stems grown and consumed in Enugu, Nigeria was investigated. The proximate and phytochemical analyses were carried out using standard methods while the mineral composition was determined using Atomic Absorption Spectrophotometer (AAS). The result of proximate analysis showed that the leaves and stems had a high percentage of carbohydrate (40.543±3.62%) (50.781±3.61%) and ash (22.144±0.472%) (23.480±0.470%), relatively low percentage of protein (9.45±1.61%) (13.988± 1.60%), Crude fiber (23.655±6.39%) (5.59±6.38%) and moisture (4.157± 0.694%) (6.12 ±0.69%) and very low percentage fats and oil (0.05±0.004%) (0.04±0.003%) respectively. The phyto chemical analyses indicated presence of Saponin (56.3±4.143) (68.02±4.143), flavonoids (5.163±0.53) (3.664±0.52), Alkaloids (0.606±0.155) (0.169±0.154), Tannin (4.956±1.084) (1.891±1.083), Phenol (1.630±0.167) (1.157±0.160) and Glycosides (0.881±0.037) (0.777±0.036) respectively. Mineral analyses indicated presence of Copper (0.213±0.09) (0.454±0.08), Magnesium (31.792±1.61) (36.334±1.60), Calcium (10.597±0.54) (12.111±0.53), Phosphorus (0.118±0.018) (0.067±0.01), Iron (0.052±0.002) (0.045±0.002) and Lead (0.00045±0.000007) (0.00043±0.000007) respectively. These findings indicate that Talinumtriangulare leaves and stems are good nutritious food materials and potential sources of phytomedicine and may validate its use in medicinal practice in Nigeria.

Keywords - Talinumtriangulare, Proximate, Phytochemical, Mineral, Malnutrition

I. INTRODUCTION

Malnutrition, in all its forms includes imbalances in the intake of energy and nutrients, vitamins or minerals deficiency, and resulting diet-related non-communicable diseases (NCD).In developing countries, including Nigeria, about 45% of deaths among the vulnerable age groups (women, children under 5 years of age and Elderly) are linked to malnutrition. The developmental, economic, social, medical impacts and the global burden of malnutrition are serious and lasting, for individuals, families, communities and countries[1]. Thus, eradication of hunger and poverty, a consequence of food unavailability, is a foremost United Nations millennium development goal (MDG)[2].

Globally, it is estimated that by 2050, 66% of the world's population is projected to live urban areas and it is expected that more than half of this growth will occur in Africa, and Nigeria will not be left out[3]-[5].Urbanization, in combination with economic and social development, leads to a change in dietary patterns and nutrient intake. This process is called 'nutrition transition' [6], and contributes to increasing health burdens and Non-Communicable Diseases (NCDs) worldwide especially in developing countries like Nigeria[7]. Studies have shown that when incomes raise, the expected is that the consumption of foods associated with a high-quality diet increases (including fruit and vegetables). However, the reality is that the consumption of food products associated with a low quality diet (including fast foods and sugar-sweetened beverages) increases even more strongly. This is because the budget share of fruits and vegetables in the total food expenditures has declined [8].

Vegetables constitute an important part of human diet, since they contain carbohydrates, proteins, fats, as well as vitamins, minerals and bioactive compounds. In recent years, there is a rapid increasing demand for green leafy vegetables among the urban community consumers resulting from increased awareness of their nutritive and herbal values. With the current wave of economic depression and its attendant effect on the population in less developed nations, the local/ indigenous food and vegetables will play an increasing role in the food and health security of the rural people and the increasing urban poor. Studies in Nigeria have shown a decline in the vegetable consumption with a resultant burden of rise in NCDs[9].

Talinumtriangulare (Jacq.) (Family: Portulaceae) commonly called waterleaf or spinach, (Igbo: 'gbolodi., Yoruba: 'gbure', 'lagosbologi'[10] is an herbaceous, annual, coalescent, and glabrous plant widely grown in tropical regions as a leafy vegetable. The most valuable and edible parts of this plant are the leaves and the stems. In southern Nigeria and Enugu in particular, it is consumed as a leafy vegetable and a constituent of sauces and vegetable soups.Nutritionally, it is a good source of protein, carbohydrate, minerals (e.g., calcium, magnesium, and potassium) and vitamins (e.g., ascorbic acid and

pyridoxine). Preliminary phytochemical studies reported the presence of carotenoids, alkaloids, flavonoids, saponins, and tannins in the leaves [11]. Further phytochemical analysis yielded campesterol, sitosterol, stigmasterol, scotenol, 3-(N-acryloyl, and N-pentadecanoyl) propanoic acid, allantoin, 3-O-bD-glucopyranosyl-sitosterol,3-O-bD-glucopyranosyl-stigmasterol, (132S,17R,18R)-phaeophytin a, 17R,18R-purpurin18 phytyl ester, ficuschlorin D acid, talichlorin A, 31,32-didehydro-151-hydroxyrhodochlorin-15-acetic acid d-lactone-152-methyl-173-phytyl ester, and hydroperoxy-ficuschlorin D [12]-[13]. Studies have indicated that extracts of T. triangulareleaves and stems showed significant antioxidant activities with significant flavonoid and phenolic acid concentrations, suggesting an immune-modulatory potential [14].

In the southern parts of Nigeria, the extracts from the leaves and roots are used as diuretics, for the management of asthma, gastrointestinal disorders, Shistosomiasis, scabies, high blood pressure, and anemia T. triangulare has commercial and economic value. It is drought resistant, thus, can be cultivated all year round, and may provide additional income for farmers[15]. Nigeria is richly endowed with natural plant resources but still struggling with malnutrition. As popular as this vegetable is in Nigeria, there is still paucity of information on the specific nutritional compositions beyond the traditional use. This is partly responsible for its underutilization. Thus this study will investigate the nutritional composition of T. triangulare (water leaf) leaves and stems and will enhance efforts towards food security and eradication of malnutrition and micronutrient deficiency.

II. DETAILS AND EXPERIMENTALS

Materials and Procedure

Plant Samples

Fresh Talinumtriangulare (water leaf) leaves and stems were obtained from Farms in Enugu, Enugu State, Nigeria. The plant samples was identified by Mr. Alfred Oziokoof the Bioresource development and Conservation Program (BDCP) Research Centre Nsukka, Enugu state, Nigeria.

Preparation of samples

The fresh T. triangulare (water leaf) leaves and stems samples were air dried for four weeks to constant weight at room temperature (29^0C- 35^0C) and ground into uniform coarse form using a milling machine. The methanolic extracts were prepared by soaking 2000 grams of dried pulverized leaves and stems samples in 1.5litres of methanol for 72 hours. They were filtered using Whatman Number 4 filter paper and the filtrates were concentrated using Rotary evaporator at regulated temperature. Phytochemical and mineral analyses were carried out on the crude methanol extracts, while proximate analysis were carried out on the dried pulverized leaves and stems samples.

Proximate Analysis

Proximate analyses were carried out according to the procedure of Association of Official Analytical Chemist[16].

Phytochemical Studies

Qualitative and Quantitative phytochemical analyses were carried out using standard methods [17] -[18] -[19]- [20].

Mineral composition was carried out using Atomic Absorption spectroscopy (AAS).

Statistical analysis

Results were expressed as mean ± SD and test of statistical significance were carried out using One-way analysis of variance (ANOVA. The test of significance was determined at $p < 0.05$. The statistical package for social science (SPSS) was used.

III. RESULTS AND DISCUSSION

PARAMETERS %	LEAF	STEM
Moisture	4.157 ± 0.694	6.12 ± 0.69
Protein	9.45 ± 1.61	13.9888 ± 1.60
Crude fibre	23.655 ± 6.39	5.59 ± 6.38
Fat/oil	0.05 ± 0.004	0.04 ± 0.0035
Ash	22.1446 ± 0.472	23.4802 ± 0.470
Carbohydrate	40.5434 ± 3.62	50.781 ± 3.61

TABLE1: Proximate composition of Talinumtriangulare (water leaf) leaves and stems

The results of proximate composition of the leaves and stem of T. triangulare (Table 1) shows a relatively high percentage of carbohydrate (40.543±3.62%) (50.781±3.61%) and ash (22.144±0.472%) (23.480±0.470%), a relatively low percentage of protein (9.45±1.61%) (13.988± 1.60%), Crude fiber (23.655±6.39%) (5.59±6.38%) and moisture (4.157± 0.694%) (6.12 ±0.69%) and very low percentage fats and oil (0.05±0.004%) (0.04±0.003%) respectively. There is however, a relatively higher Crude fibre content in T. triangulareleaves (23.655 ± 6.39) than in the stem (5.59 ± 6.38). This result is an indication that T. triangulareleaves and stem may be ranked as carbohydrate rich and may serve as a good source of energy but it may not be considered a good source of protein and vegetable fats and oil. The relatively high ash content is an indication of its high mineral content and the relatively low moisture content suggests stability against microbial growth and good storage potentials[21] -[22].

PARAMETERS	LEAF	STEM
Alkaloid	+	+
Flavonoid	++	++
Tannin	++	+
Glycosides	+	+
Saponin	+++	+++
Phenols	+	+

TABLE 2: Qualitative phytochemical composition of Talinumtriangulare (water leaf) leaves and stems

Key:
+++ High
++ Moderate
+ Low

PARAMETERS	LEAF	STEM
Alkaloid	0.6065 ± 0.155	0.1695 ± 0.154
Flavonoid	5.163 ± 0.53	3.664 ± 0.52
Tannin	4.9565 ± 1.084	1.891 ± 1.083
Glycosides	0.8814 ± 0.037	0.7778 ± 0.036
Saponin	56.3 ± 4.143	68.02 ± 4.143
Phenols	1.630 ± 0.167	1.1571 ± 0.160

TABLE3: Quantitative phytochemical composition of Talinumtriangulare (water leaf) leaves and stems

The results of the qualitative phytochemical analyses (Table 2) revealed the presence of Saponin (56.3±4.143) (68.02±4.143), flavonoids (5.163±0.53) (3.664±0.52), Alkaloids (0.606±0.155) (0.169±0.154), Tannin (4.956±1.084) (1.891±1.083), Phenol (1.630±0.167) (1.157±0.160) and Glycosides (0.881±0.037) (0.777±0.036) respectively. Results of quantitative phytochemical analyses showed a non-significant difference ($p > 0.05$) in the phytochemical compositions of T. triangulare leaves when compared with that of the stems (Table 3). The presence of these phytochemicals is an indication that T triangulareleaves and stems can protect against diet related diseases and may offer medicinal and chemo protective benefits to consumers. The relatively high presence of Saponin makes the vegetable a good candidate for fight against infections and microbial invasions.

PARAMETERS	LEAF	STEM
Magnesium	31.7924 ± 1.61	36.3341 ± 1.60
Calcium	10.5975 ± 0.54	12.1114 ± 0.53
Copper	0.2131 ± 0.09	0.4540 ± 0.08
Lead	0.00045 ± 0.0000071	0.00045 ± 0.0000071
Phosphorus	0.1189 ± 0.0181	0.067 ± 0.0183
Iron	0.0524 ± 0.002	0.0456 ± 0.0024

TABLE4: Mineral composition of Talinumtriangulare (water leaf) leaves and stems

The results of mineral composition of the leaves and stems of T. triangulare (Table 4) showed a non-significant difference ($p > 0.05$) in the mineral compositions of T. triangulare leaves when compared with that of the stem. Magnesium was the highest among the minerals analysed with 31.7924 ± 1.61 for the leaves and 36.3341 ± 1.60 for the stems while Lead (Pb) was the lowest among the minerals analysed with 0.00045 ± 0.0000071 for the leaves and 0.00045 ± 0.0000071 for the stems. Results also showed that the leaves and stems of this plant are sources of Calcium (10.5975 ± 0.54; 12.1114 ± 0.53), Phosphorus (0.1189 ± 0.0181; 0.067 ± 0.0183), Copper (0.2131 ± 0.09; 0.4540 ± 0.08) and Iron (0.0524 ± 0.002; 0.0456 ± 0.0024) for leaves and stems respectively. Magnesium (Mg), Calcium (Ca), Phosphorus (P), Copper (Cu) and Iron (Fe) compared favorably with findings reported in some other leafy vegetables consumed locally in Enugu and Nigeria [23] - [24] - [25].

Magnesium is essential to all living cells, where they play a major role in the functioning of important biological polyphosphate compounds like ATP, DNA and RNA. Calcium has been reported to aid the growth and maintenance of bones, teeth and muscles. Iron (Fe) is an essential trace element for hemoglobin formation, oxidation of fat, carbohydrate and proteins. Phosphorus (P) is essential in the synthesis of protein, the growth, maintenance and repair of cells and tissues. Copper (Cu) helps to produce red and white blood cells and triggers the release of iron to form hemoglobin[26].

IV. CONCLUSION

In conclusion, the leaves and stems of Talinumtriangulare are good sources of nutritious food material, energy, proteins and minerals and thus could be harnessed to fight malnutrition and micronutrient deficiency. They contain important phytochemicals (Saponin, Alkaloid, flavonoid, phenol, tannin and glycoside,) and may offer medicinal and chemo protective benefits. An increased consumption of the leaves and stems of Talinumtriangulare is therefore recommended in addition to the commercial cultivation and conservation to enable continuous availability all year round.

ACKNOWLEDGEMENT

I wish to acknowledge Moses Ezenwali (Ph.D),Head of laboratory services and all the technical staff of Brain–phosphorylationship scientific solution services for their cooperation.

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