World Journal of Advanced Engineering Technology and Sciences

eISSN: 2582-8266

Cross Ref DOI: 10.30574/wjaets

Journal homepage: https://wjaets.com/

(RESEARCH ARTICLE)

Proximate and mineral composition of some wild leafy vegetables consumed in Katsina State Nigeria

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World Journal of Advanced Engineering Technology and Sciences, 2023, 09(01), 084–088

Publication history: Received on 04 April 2023; revised on 13 May 2023; accepted on 16 May 2023

Article DOI: https://doi.org/10.30574/wjaets.2023.9.1.0141

Abstract

In Sub Saharan Africa, people utilised wild leafy vegetables and herbs in order to meet the daily recommended nutritional requirements for the betterment of health and general well being, In this study, seven wild leafy vegetables consumed in Katsina State, Nigeria were studied for their proximate analysis and mineral composition. *B. salicifolia* (Capparaceae), *T. globiferus* (Loranthaceae), *F. glumosa* (Moraceae), C. *religiosa* (Capparaceae), *M. angolensis* (Capparaceae), *S.occidentalis* (Fabaceae) and *P.thonningii* (Fabaceae), were evaluated using standard methods. The results showed that, Carbohydrates is the most abundant nutrient present in the selected plants. The crude protein ranged from 13.23– 9.33.% with *F. .glumosa* and *B. salicifolia* providing the highest amount. The elemental analysis in ppm/l revealed the presence of Iron, Calcium within recommended daily values and low level of heavy metals in all the samples. The selected plants may therefore be considered as viable and cheap sources of dietary nutrients and their incorporation in diets may be said to be scientifically justifiable..

Keywords: Wild; Edible; Leafy vegetables; Nutrients; Minerals

1. Introduction

Human needs to consume food compounds such as carbohydrates, protein, fats and vitamins to meet their nutritional requirements. However, rising food and nutritional insecurity accompanied by growing world population threatens the livelihoods of millions of poor people, particularly in Sub-Saharan Africa (SSA). At the very least, 123 million people—or 12 percent of the population of SSA—are anticipated to experience acute food insecurity in 2022, suffering from severe malnutrition and unable to achieve their bare survival requirements [1]. In many developing countries the supply of minerals is inadequate to meet the mineral requirements of rapidly growing population. In Nigeria, 55 per cent of adolescent girls and women suffer from anaemia while nearly half of Nigerian women of reproductive age do not consume the recommended diet [UNICEF malnutrition in Nigeria: https://www.unicef.org/nigeria/press-releases/73-million-adolescent-girls-and-women reproductive-age-nigeria-are-undernourished] Last acessed 8th May, 2023

The mineral supply in many developing nations is insufficient to meet the needs of the fast expanding population and must be provided from plants or mineral-rich water [2]. It is important to remember that eating a variety of edible plants as a food source may benefit nutritionally vulnerable populations, especially in emerging nations where poverty and climate are devastating the rural population[3].

Wild edible plants (WEPs) are native plant species that grow and reproduce naturally in their natural habitat without being cultivated and humans have gathered WEPs since ancient times, and they have become part of the human diet and traditional food Systems [4]. According to [4] WEPs play an important role in promoting sovereignty and food security there by ensuring food availability when food crops are scarce, and they potentially contribute to well-being in

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vulnerable households. In many Nigeria's rural settlements WEPs are valuable sources of nutrients where they contributes substantially to protein, minerals, vitamins, fibers and other nutrients which are usually in short supply in daily diets [5].

There has been extensive research on vegetables but little information is available on nutritive value of unconventional leafy vegetables of this area, keeping this in view, an investigation was carried out to assess the nutrient composition of few selected species of wild leafy vegetables of Katsina State Nigeria.

2. Material and methods

2.1. Study Area

Katsina state is situated in the north-western part of Nigeria between latitude 11°08′ N and 13°22′, and longitude 6°52′ E and 9°20′ E, comprising an area of 23,938 km^2. This state has territorial boundaries with Kano and Jigawa states to the east, Kaduna state to the south, and Zamfara state to the west. The Republic of Niger is located to the north. The state is part of the large high plains of Hausa land. Katsina is classified into two distinct climatic zones on the basis of seasonal variations and months: tropical continental and semi-arid continental.

2.2. Plant Materials

Collection of samples: seven (7) species of wild green leafy vegetables that are consumed widely in rural areas of Katsina state were selected and collected from farms and backyard of Federal College of Education Katsina in a bulk. All the samples were identified and authenticated at Herbarium of Ahmadu Bello University Zaria. A general account of the selected vegetables is presented in table 1.

Preparation of sample: leaves were sorted to remove foreign substances as well as thoroughly washed in water 2-3 times to remove the adhering dust and impurities and were dried in shade. The dried leaves were ground into powder using pestle and mortar. The ground portion was kept in a plastic bottle prior analysis.

Table 1 List of plants use in the study

S/N	Plant	Family	Local name	habit	Part utilised	Method of consumption	Season of consumption
1	*Boscia salicifolia* Oliv.	Capparaceae	Zure	tree	leaf	cooked	dry season
2	*Tapinanthus globiferus* A. Rich	Loranthaceae	Kauci	tree	leaf	cooked	dry season
3	*Ficus glumosa* Delile	Moraceae	Kawari	tree	leaf	cooked	dry season
4	*Crateva religiosa* G.Fors*t*	Capparaceae	Ingududu	tree	leaf	cooked	All season
5	*Maerua angolensis* DC	Capparaceae	Cìcìwáá	tree	leaf	cooked	All season
6	*Senna occidentalis* (L.) Link	Fabaceae	Rai dore	woody herb	leaf	cooked	Rainy season
7	*Piliostigma thonningii* (Schumach.) Milne-Redh.	Fabaceae	Kalgo	shrub/tree	young leaf	cooked	All season

2.3. Proximate Analysis

Moisture, ash, crude fat, crude fat and crude fibre were determined in accordance with the official methods of the association of official analytical chemists [6], while nitrogen was determined by the micro-kjeldahl method [7] and the percentage of nitrogen was converted to crude protein by multiplying by 6.25. Carbohydrate content was determined by subtracting total sum of ash, crude fiber, crude fat and protein from 100.

2.4. Mineral Analysis

The minerals in the leafly vegetables were analysed from solution obtained when 0.5 of the samples were digested with concentrated nitric acid and concentrated perchloric acid in ratios 5:3, the mixtures were placed on a water bath for three hours at 80^{o}C. The resultant solution was cooled and filtered into 100ml standard flask and made to mark with distilled water [8]. Atomic absorption sphectrophotometer (Model 6800 Shimadzu Japan) was used. All the analysis of each sample was performed in triplicates.

3. Results

Table 2 Proximate analysis result

S/N	Plant	% Ash	% Moisture	% Crude Protein	% Crude Fats	% Crude Fibre	% Carbohydrate
1	*B. salicifolia*	10.38	5.28	12.28	3.27	4.83	63.96
2	*T. globiferus*	8.55	6.32	9.65	2.93	6.05	66.50
3	*F. glumosa*	9.06	4.03	13.23	4.68	3.96	65.04
4	*C. religiosa*	11.22	4.68	8.93	4.53	2.67	67.97
5	*M. angolensis*	9.8	3.96	9.03	3.96	3.58	69.60
6	*S. occidentalis*	7.95	4.23	9.33	5.13	4.41	68.95
7	*P. thonningii*	9.44	4.89	10.58	3.66	7.23	64.20

Table 3 Mineral analysis result

SN	SAMPLE	Fe	Cd	Zn	Pb	Ni	Ca	Mg	Na
1	*B. salicifolia*	1.500± 0.057	0.001± 0.003	0.924± 0.008	0.026± 0.023	0.030± 0.048	37.02± 0.41	2.8872± 0.0267	6.66± 0.69
2	*T. globiferus*	1.257± 0.041	0.006± 0.000	0.205± 0.002	0.019± 0.014	0.033± 0.011	38.64± 1.47	2.6602± 0.1496	6.84± 0.13
3	*F, glumosa*	4.330± 0.107	0.020± 0.002	0.390± 0.004	0.014± 0.027	0.351± 0.027	5.85± 0.62	3.5576± 0.1191	6.37± 1.31
4	*C. religiosa*	2.934± 0.038	0.029± 0.001	0.513± 0.003	0.033± 0.025	0.458± 0.046	41.91± 2.54	3.4022± 0.1134	5.57± 0.46
5	*M. angolensis*	4.588± 0.051	0.026± 0.001	0.670± 0.008	0.043± 0.002	0.588± 0.065	7.66± 1.04	3.2174± 0.2800	7.8±0.38
6	*S. occidentalis*	4.943± 0.043	0.030± 0.001	0.908± 0.003	0.096± 0.0057	0.738± 0.076	1.24± 0.13	1.9988± 0.2857	5.91± 0.60
7	*P. thonningii*	3.323± 0.009	0.030± 0.001	0.944± 0.001	0.136± 0.0115	0.881± 0.056	0.350.± 02	1.8044± 0.2776	3.88± 0.24
	WHO/FAO STD	425.5	0.2	99.4	0.3	67.9	2500	420	-

4. Discussion

The proximate analysis in Table No.2 revealed that all the plants have a very rich concentration of Carbohydrates 63.98% - 69.60% but reasonable concentration of crude protein was found in *F. glumosa* (13.23), *B. salicifolia* (12.28) and *P. thonningii* (10.58) According to [9] plant foods that provide more than 12% of their calorific value from protein have been shown to be good source of protein. The crude fibre content ranged between 3.58% - 7.23% the highest value was

recorded in *P. thonningii* . The values found for lipids in these veggies species ranges from 5.13 to 2.93, it is clear that the lipid content of the leafy vegetables under investigation is low. It's vital to remember that 1 to 2 percent of calories should come from fat in a diet for humans, as more fat consumption increases the risk of cardiovascular diseases including atherosclerosis, cancer, and aging [10]. Therefore, individuals who suffer from obesity may be advised to consume these leafy vegetables in large quantities [11].

The minerals present in the different extracts were analysed using Atomic Absorption Spectrophotometer (model 6800 Shimadzu Japan). The results for the analysis of the essential elements in the plants are presented in Table **3**. The mineral contents of the selected plants varied comparatively. Ash content was relatively high with values ranging from 11.22 % for *C. religiosa* to 7.95 in *S. occidentalis,* these values indicate that these vegetables species may be considered as good sources of minerals and with their low moisture content less than 10% they are good for storage as they are less prone to deterioration due to microbial activities.

All the heavy metals analyzed were within the WHO/FAO permissible limits (table 3), this implies that the plants have low risk of toxicity of heavy metals, more over, the plants shows variations in essential elements concentrations. Iron which is useful in the prevention of anaemia and other related diseases was found to be highest in *S. occidentalis* (4.94ppm/l), *M. angolensis* (4.58ppm/l) and *F. glumosa* (4.33ppm/l). Calcium which is important for bone health was found to be high among three plants of the Capparidae family 41.0ppm/l in *C.religiosa,* 38.64ppm/l in *M.angolensis* and 37.0ppm/l in *B.salicifolia*. *P. thoningi*i has the lowest concentration of Calcium 0.35ppm/l. this implies that those three plants may be use as a good source of Calcium for proper bone health. Both samples contain low amount (less than 10mg) of Sodium (table 3) an essential mineral that plays a key role in normal nerve and muscle function hence the plants can be consumed safely without risk of promoting cardiovascular diseases since they contain Sodium ion within the permissible limit. Though from the study, the magnesium (Mg) concentration varies among the samples the highest was recorded from *F. glumosa* (3.55ppm/l) and lowest in *P. thonningii* (1.8 ppm/L) likewise Zinc (Zn) concentration was highest in *P. thonningii* 0.9ppm/l and lowest in *T. globiferus* 0.2ppm/l. Magnesium, like calcium, plays an essential role in the regulation of intracellular acid-base balance, as well as the activation of enzymes, stimulation of muscle and nerve irritability (contraction), and the metabolism of carbohydrates, proteins, and lipids[12]. The results revealed that the selected plants contain essential micro and macronutrients for good health.

5. Conclusion

This study has shown that the leaves of *B. salicifolia*, *T. globiferus*, *F. glumosa*, C. *religiosa*, *M*. *angolensis*, *S. occidentalis* and *P. thonningii* are a rich source of iron, calcium, carbohydrate, fibres and lipids. *B. salicifolia, F. glumosa, and P. thonningii* are good source of Proteins in addition to essential minerals. Though not all of them provide nutrients required by man, they are quite safe for consumption, viable and cheap may be recommended in diets to aid in the fight against malnutrition.

Compliance with ethical standards

Acknowledgments

This research is an institutional based research (IBR) funded by Tertiary Education Trust fund (TETFUND) hence, the authors acknowledge financial support from TETFUND and the management of Federal College of Education, Katsina.

Disclosure of conflict of interest

The authors declare that there is no conflict of interest. The authors alone are responsible for the content of the paper.

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