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DISTRIBUTION OF NUTRITIVE ELEMENTS IN WATERLEAF (*Talinum triangulare*) and JUICE MALLOW (*Corchorus olitorus*)

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ABSTRACT

Two locally consumed leafy vegetables, *Talinum triangulare* and *Corchorus olitorus*, were analysed for the distribution of seven nutritive elements in their leaves, stems and roots. The levels of Potassium, Sodium and Calcium were determined by flame photometry while the levels of Magnesium, Zinc, Iron and Copper were determined by atomic absorption spectrophotometry. The following concentration ranges (in mg100g^{-1} dry weight) were obtained for the elements determined:Potassium, 437.50 – 7695.00; Sodium,101.70 – 193.50; Calcium, 96.50 – 549.70; Magnesium, 180.10 – 900.00; Zinc, 2.68 – 25.00; Iron, 6.50 – 18.76; Copper, 0.55 – 1.05. *Talinum triangulare* was observed to be richer in Potassium, Sodium, Calcium, Magnesium and Zinc except Iron than *Corchorus olitorus* while the distribution of Copper was observed to be similar in the two vegetables.

Key Words: Vegetables, Atomic-flame photometry, mineral distribution.

INTRODUCTION

Mineral elements, though usually form a small portion of total composition of most plant materials and of total body weights, are nonetheless of great physiological importance particularly in the body metabolism(Kortstee,1970; Pories *et al*, 1967; Pyke,1987). Their effects are related to concentration and recorded observations range from a deficiency state to role as essential component of enzymes, to imbalance created when excess of one interferes with the functions of another, to pharmacological activities (Bothwell and Bradlow1989; Feldman,1976; Fox, 1971). Vegetables offer the most rapid and lowest cost method of providing adequate supplies of minerals to the people living in the tropics (Rice and Tindall, 1986). Owing to traditional food habits and economic considerations, Nigerians consume a significant quantity of vegetables.

This fact makes a comprehensive analysis of these green leafy vegetables very important. Since the list of locally consumed vegetables varies with ethnic groups, those used in this work are those commonly consumed in south–western part of Nigeria. Water leaf (*Talinum triangulare*) is one of the popular green leafy vegetables that grow wildly and seasonally in Nigeria. It's leaves and stems, both green and dry, are used as vegetable.

Juice mallow (*Corchorus olitorus*) is also a popular green leafy vegetable widely cultivated in Nigeria. It's green leaves are also used as vegetable. Previous works on water leaf and juice mallow Faboya (1983); Aremu and Udoessien (1990), were limited to the leafy part of the vegetables. Therefore, the aim of this study is to establish the distribution of the essential elements in all parts of the vegetables (Leaf, Stem and Root).

This will update and supplement existing data with respect to the inorganic constituents of the vegetables' leaves and provide baseline data with respect to other parts of the green leafy vegetables.

MATERIALS AND METHOD

Sample collection and Pretreatment

Five samples of each vegetable were collected at five different locations in Abeokuta and were immediately transferred to the laboratory in clean plastic bags. Each sample was thoroughly rinsed with distilled deionised water and left to drain at room temperature. The leaves, stems and roots from pooled sample were then separated and dried to constant weight in an oven at 70^{0}C. The dried samples were

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TABLE 1: Moisture Content (%)

SAMPLE	SAMPLING POINT					M ± SD
Talinum triangulare	Alabata	Kobape	Elega	Ojere	Obantoko	
Leaf	92.20	93.48	92.40	90.20	92.21	92.10 ± 1.19
Stem	92.10	91.36	91.30	91.60	90.30	91.33 ± 0.66
Root	86.45	86.57	81.50	80.70	81.30	83.30 ± 2.94
Corchorus olitorus						
Leaf	86.10	85.90	85.70	86.22	86.50	86.08 ± 0.31
Stem	87.50	86.80	87.00	87.20	86.30	86.96 ± 0.45
Root	67.10	68.20	67.90	67.30	67.40	67.58 ± 0.45

TABLE 2: Ash Content (%) DM

SAMPLE	SAMPLING POINT					M ± SD
Talinum triangulare	Alabata	Kobape	Elega	Ojere	Obantoko	
Leaf	1.96	2.34	3.00	2.70	2.60	2.52 ± 0.39
Stem	2.10	2.10	2.90	3.20	2.90	2.64 ± 0.50
Root	2.50	3.03	3.40	3.60	3.90	3.29 ± 0.54
Corchorus olitorus						
Leaf	5.70	6.10	5.80	6.00	5.90	5.30 ± 0.16
Stem	5.60	6.20	5.90	5.90	6.10	5.94 ± 0.23
Root	6.10	5.90	6.40	6.70	6.90	6.40 ± 0.41

TABLE 3: Mineral Element Composition of *Talinum triangulare* (mg100g^{-1}) DM

ELEMENT	LEAF	STEM	ROOT
Potassium (K)	5471.25 ± 16.10	7695.00 ± 5.90	3138.75 ± 20.10
Sodium (Na)	193.50 ± 5.40	116.00 ± 2.80	142 ± 1.68
Calcium (Ca)	549.70 ± 4.50	225.00 ± 2.90	536 ± 4.30
Magnesium (Mg)	900.00 ± 6.70	540.00 ± 4.30	510.00 ± 4.10
Zinc (Zn)	25.00 ± 1.20	2.75 ± 0.50	9.75 ± 0.80
Iron (Fe)	12.25 ± 1.00	6.50 ± 0.70	17.50 ± 1.40
Copper (Cu)	0.93 ± 0.20	0.55 ± 0.10	0.66 ± 0.10

Mean of triplicate measurements

TABLE 4 : Mineral Element Composition of *Corchorus olitorus* (mg100g^{-1}) DM

ELEMENT	LEAF	STEM	ROOT
Potassium (K)	437.50 ± 3.70	6075.10 ± 17.10	3915.10 ± 20.70
Sodium (Na)	169.20 ± 1.70	160.20 ± 1.80	101.70 ± 1.10
Calcium (Ca)	375.60 ± 4.00	480.20 ± 4.7[illegible]	96.50 ± 1.00
Magnesium (Mg)	480.40 ± 4.30	510.30 ± 4.00	180.10 ± 1.70
Zinc (Zn)	4.70 ± 0.70	3.85 ± 0.50	2.68 ± 0.60
Iron (Fe)	17.50 ± 1.50	7.00 ± 0.80	18.76 ± 1.50
Copper (Cu)	1.05 ± 0.20	0.65 ± 0.10	0.65 ± 0.10

Mean of triplicate measurements

DM ---- Dry matter

subsequently used for the analysis.

Method

2g of the dried sample were ashed in a muffle furnace for 16hr at 450^{0}C. The residual ash was dissolved in 5ml concentrated HNO_3. This was transferred quantitatively into a 250cm^3 volumetric flask and 10cm^3 of Lanthanum chloride added to act as ionisation suppressant and the solution was made up to the mark with deionised water. The resulting solution was used directly for all the analyses. K, Na and Ca were determined using PFP7 Jenway flame photometer while Mg, Fe, Zn and Cu were determined by Pye–Unicam SP–9 Atomic absorption spectrophotometer using appropriate hollow cathode lamps.

All analytical estimations were done in triplicate and the data reported in mg100g^{-1} on dry matter basis. Blank samples were also prepared similarly under similar conditions. All reagents were of analytical grade.

RESULTS AND DISCUSSION

The moisture content of the vegetables is as shown in Table 1, the total ash in Table 2 and the mineral elements of *Talinum triangulare* in Table 3 and the mineral elements of *Corchorus olitorus* in Table 4.

As shown in Table 1, *Talinum triangulare* had an average moisture content of 92.10% in it's leaf, 91.33% in it's stem and 83.30% in it's root while *Corchorus olitorus* had an average moisture content of 86.03% in it's leaf, 86.96% in it's stem and 67.58% in it's root. The highest moisture content (92.10%) was found in the leaf of *Talinum triangulare* and the least (67.58%) was found in the root of *Corchorus olitorus*. The high moisture content of water leaf suggests that it loses considerable amount of water and may not keep for long at room temperature (Ladeji, *et al*,1995). However, the moisture content values reported for the two vegetables in this work agreed with the values reported for *Talinum triangulare*, 94.10%(Leaf) and *Corchorus olitorus*, 90.60%(Leaf) by Faboya (1983).

The ash content of the vegetables as shown in Table2 revealed it's distribution in various parts of the vegetables. The least value of 2.52% was observed in the leaf of *Talinum triangulare* and the highest value of 6.40% was observed in the root of *Corchorus olitorus*. The leaf of *T. triangulare* was observed to have an ash content of 2.52% while a value of 2.64% was obtained in it's stem and the root contained 3.2%. On the other hand, the leaf *of C. olitorus* contained 5.90% while the stem and the root contained 5.94% and 6.40% respectively However, *T. triangulare* was observed to have lower ash content than *C. olitorus*. The lower ash content of *T. triangulare* may be an indication of lower inorganic elements. The values reported for the leaves of the two vegetables (*T. triangulare*, 2.52%; *C. olitorus*, 5.90%) did not agree with the values reported for the leaves of the vegetables by Faboya (1983): *T. triangulare*, 22%; *C. olitorus*, 21.00% and 16.00%. This may be due to difference in location.

Seven minerals were determined in the vegetables; K was the most abundant, ranging from 437.50mg100g^{-1} in the leaf of *C. olitorus* to 7695.00mg100g^{-1} in the stem of *T. triangulare*. The values of 3138.75mg100g^{-1} and 5471.25mg100g^{-1} were obtained in the root and leaf of *T. triangulare* respectively while values of 3915.10mg100g^{-1} and 6075.10mg100g^{-1} were obtained in the root and stem of *C. olitorus*. The value of K obtained in the leaf of *T. triangulare* was higher than the value reported by Aremu and Udoessien.,1990 (3166.00mg100g^{-1}). It is noteworthy that there is a very significant difference in K content of the leaf of *C. olitorus* (437.50mg100g^{-1}) and the leaf of *T. triangulare* (5471.25mg100g^{-1}). Food and Nutrition Board recommendation for K is 350–925mg, 550–1650mg and 1875–5625mg for infant, children and adults respectively. The vegetable will be a very good source of K to balance the high Na intake through food additive e.g. table salt (NaCl) for improvement of taste. Food and Nutrition Board have recommended that K intake should equal Na intake to counteract the effect of Na in raising blood pressure.

Mg, Ca and Na were the next elements reasonably present in the vegetables as shown in Tables 3 and 4. The values of Mg ranged from 180.10mg100g^{-1} in the root of *C. olitorus* to 900.00mg100g^{-1} in the leaf of *T. triangulare*. The values of 510.00mg100g^{-1} and 540.00mg100g^{-1} were obtained in the root and stem of *T. triangulare* while values of 480.40mg100g^{-1} and 510.30mg100g^{-1} were obtained in the leaf and stem of *C. olitorus* respectively .The leaf of *T. triangulare* was observed to be richer in Mg (900.00mg100g^{-1}) than the leaf of *C. olitorus* (480.40mg100g^{-1}). A comparison of the Mg level in the leaf of *T. triangulare* reported in this work with the values reported by Aremu and Udoessien (1990) revealed higher values for our work. Food and Nutrition Board recommended Mg intake was set at 300–350mgday^{1}. The concentration of Mg in the vegetable, especially in the leaves, is adequate for human diet if losses during food processing could be prevented.

The Ca levels observed in this work are in the range 96.50mg100g^{-1} (*C. olitorus* root)–549.70mg100g^{-1} (*T. triangulare* leaf). The Ca levels of the stem and root of *T. triangulare* were 225.00mg100g^{-1} and 536.25mg100g^{-1}. The values obtained in the leaf and stem of *C. olitorus* were 375.60mg100g^{-1} and 480.20mg100g^{-1} respectively. There is no significant difference noted in the distribution of Ca in various parts of the vegetables except the roots. The root of *C. olitorus* was observed to contain 96.50mg100g^{-1} of Ca while that of *T. triangulare* contained 536.25mg100g^{-1}. The Ca content of the leaf of *T. triangulare* (549.70mg100g^{-1}) was higher than that of *C. olitorus* (375.60mg100g^{-1}) and similar pattern was observed in the stem (Tables 3 and 4).

Food and Nutrition Board recommended Ca intake is 360 – 540mg, 800mg and 800 – 1200mg day^{-1} for infant, children and adult respectively. If all the Ca in the vegetables were in the available form and no loss during food processing, they could serve as good sources of calcium.

The levels of Na obtained in this work ranged from 101.70mg100g^{-1} in the root of *C. olitorus* to 193.50mg100g^{-1} in the leaf of *T. triangulare*. The values of 116.00mg100g^{-1} and 142.20mg100g^{-1} were obtained in the stem and root of *T. triangulare* while values of 160.20mg100g^{-1} and 169.20mg100g^{-1} were obtained in the stem and leaf of *C. olitorus*. A comparison of the level of Na obtained in this work agreed with the value reported for the leaf of *T. triangulare* (183.50mg100g^{-1}) by Aremu and Udoessien (1990).

Food and Nutrition Board recommendation for Na intake is 1100–3300mgday^{-1} which is often met through food additives, the low concentration of Na (101.70–193.50mg100g^{-1}) could be an advantage to hypertensive patients.

Zn, Fe and Cu were found to be present in relatively low amounts (Tables 3 and 4). Zn ranged from 2.68mg100g^{-1} in the root of *C. olitorus* to 25.00mg100g^{-1} in the leaf of *T. triangulare*. The distribution of the element in the stem and root of *T. triangulare* were 2.75mg100g^{-1} and 9.75mg100g^{-1} while the values of 3.85mg100g^{-1} and 4.70mg100g^{-1} were obtained in the stem and leaf of *C. olitorus* respectively. The values of the element reported in the leaves of the vegetables in this work agreed with values reported by Faboya (1983) *T. triangulare* (5.40mg100g^{-1}), *C. olitorus* (3.70mg100g^{-1} and 4.10mg100g^{-1}); Aremu and Udoessien(1990) *T. triangulare* (28.93mg100g^{-1}).

Fresh fruits and leafy vegetables have been reported to be relatively poor sources of Zn, Underwood, E.J., 1977. The levels of Zn reported appear to confirm this. Food and Nutrition Board recommended Zn intake was set at 15mgday^{-1} in adult, plus 5mg addition during pregnancy and 10mg during lactation. In view of the low concentration of Zn observed in various parts of the vegetables except the leaf of *T. triangulare* (25.00mg100g^{-1}), only the leaf of *T. triangulare* is nutritionally significant for level of Zn.

The levels of Fe ranged from 6.50mg100g^{-1} in the stem of *T. triangulare* to 18.76mg100g^{-1} in the root of *C. olitorus*. Both the root of *T. triangulare* and leaf of *C. olitorus* had similar level of Fe(17.50mg100g^{-1}). The level of Fe observed in the stem of *C. olitorus* was 7.00mg100g^{-1} while a value of 12.25mg100g^{-1} was obtained in the leaf of *T. triangulare.* The levels of Fe observed in this work for the leaves of the vegetables were lower than the values reported by Faboya(1983) and Aremu and Udoessien(1990).

Food and Nutrition Boaro recommended Fe intake is set at 15mg and 18mgday^{-1} for children and adult respectively. The vegetables are averagely good sources of Fe (6.50–18.76mg100g^{-1}) from the results of this work. The highest concentration of Fe was observed in the root of *C. olitorus.* The root is not usually consumed in any form by human being in Nigeria.

The Cu levels ranged from 0.55mg100g^{-1} in the stem of *T. triangulare* to 1.05mg100g^{-1} in the leaf of *C. olitorus*. Similar level of Cu was found in the stem and root of *C. olitorus* (0.65mg100g^{-1}) while 0.66mg100g^{-1} and 0.93mg100g^{-1} were observed in the root and leaf of *T. triangulare*. The level of Cu in leaf of *T. triangulare* reported in this work was lower than 3.31mg100g^{-1} reported by Aremu and Udoessien (1990).

The values in this report supplement the existing data on Cu since little information was found in the literature concerning the Cu levels in foodstuffs in general. Food and Nutrition Board recommended Cu intake is 2–3mgday^{-1} for adults and 1–1.5mg for children. Since Cu deficiency has not been reported in human consuming a varied diet (Faboya,1983), these vegetables could serve as good sources for dietary copper.

Generally, *T. triangulare* appeared to be richer in mineral elements K, Mg, Ca, Na and Zn than *C. olitorus* except Fe. The levels of Cu in the two vegetables are similar.

CONCLUSION

The present study shows the amount of various elements in different parts of *Talinum triangulare* and *Corchorus olitorus* (Leaf, Stem and Root). The two vegetables were found to be very rich in K in all parts investigated and this could be adequate to balance high Na intake. Mg, Ca and Na were also found to be at moderate levels in leaf and stem that are adequate to meet recommended daily dietary allowance. It has equally been found that Zn , Fe and Cu are present at moderately low level that could augment other food sources to meet recommended daily dietary allowance.

From the results, the leaves and stem of the vegetables were observed to be rich in some of these nutritive elements and it is recommended that the stems of the vegetables be consumed along with the leaves. The roots of the vegetables, though rich in some of these nutritive elements, are traditionally and ignorantly not consumed due to the hard texture of this part.

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