Nutrient Content of the Leaves of *Rumex acetosa*

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Abstract: The leaves of *Rumex acetosa* (Sorrel) was analyzed for its proximate and mineral composition using standard methods of food analysis. The result of the proximate indicated higher carbohydrate content of 63.81 ± 0.18% which give rise to higher energy value since carbohydrate is a source of energy respectively. The leaves also had high energy value of 228.40 ± 0.27 Kcal/100g. The mineral composition in mg/100g dry weight are K(2132.85 ± 3.52), Na(28.61 ± 0.48), Ca(53.25 ± 0.05), P(7.73 ± 0.07), Mg(73.56 ± 0.02), Cu(0.85 ± 0.04), Fe(10.81 ± 0.04), Mn(13.59 ± 0.04) and Zn(2.66 ± 0.01). Higher potassium content in the leaves of this plant make it a better diets for hypertensive patient since any diets rich in potassium can reduce the risks of hypertension and possibly strokes. This findings also confirmed that the leaves of *Rumex acetosa* are rich sources of potassium, magnesium, copper, iron, manganese, and zinc as well as high energy values essential in human and animal nutrition.
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1. Introduction

Sorrel (*Rumex acetosa)* also known as Spinach Dock or Narrow-leaved Dock, is a perennial herb that is cultivated as a garden herb or leafy vegetable (Pot herb). The vernacular names include Yakuwa (Hausa), Emagi (Nupe) and Isapa (Yoruba) Abdullahi et al. (2003). Sorrel is a slender plant about 60 cm high, with roots that run deep into the ground, as well as juicy stems and edible, oblong leaves. The lower leaves are 7 to 15cm in length, slightly arrow – shaped at the base, with very long petioles. The upper ones are sessile, and frequently become crimson. In some Hausa communities, the leaves of sorrel are steamed and made into salad using Kuli-Kuli (traditional roasted peanut cakes that its oil has been extracted), salt, pepper, onion and tomatoes. The recipe varies according to different level of household income. The plant is also called "Cuckoo's – meate" from an old belief that the bird cleared its voice by its agency. Domestic animals are found of this. The leaves contain a considerable quantity of binoxalate of potash, which gives them their acid flavour and medicinal and dietetic properties. The leaves may be poured in soups and sauces or added to salads. The leaves of sorrel may also with advantage be added to turnips and spinach. When boiled by itself, without water, it serves as an excellent accompaniment to roast goose or pork, instead of apple sauce. The dried and fresh leaves of sorrel have medicinal value. The medicinal action of sorrel is refrigerant and diuretic, and it is employed as a cooling drink in all febrile disorders. Sorrel (2009).

The aim of this work was to conduct an investigation of the nutritional composition of the leaves of *Rumex acetosa* (Sorrel) in order to ascertain it's suitability for use in human diets or animal feeds.

2. Materials and methods

2.1 Sample collection and sample treatment

The sample of *Rumex acetosa* used in this study was collected from a farm site at Chanchaga in Minna town, Niger state, Nigeria.

Prior to analysis, the leaves were separated from the stems and washed with tap water then rinsed with distilled water. The residual moisture was evaporated at room temperature thereafter the leaves was oven dried at 60^0C until properly dried. The dried leaves were then ground in porcelain mortar, sieved through 2 mm mesh sieve and stored in plastic container . The powdered sample was used for both proximate and mineral analysis. Moisture content was determined using fresh leaves.

2.2 Proximate analysis

The moisture content of the leaves were determined by drying 5 g of the leaves (in triplicate) in a Gallenkamp oven at 105^0C until constant weight was attained. AOAC (1990). Ash content was determined according to the method described by Ceirwyn (1995) which involved dry ashing in Lenton muffle furnace at 600^0C until grayish white ash was obtained. Crude protein content was calculated by multiplying the value obtained from kjeldahl's nitrogen by a protein factor of 6.25 AOAC (1990). Crude lipid was quantified by the method describe by

AOAC (1990) using the soxhlet apparatus and petroleum ether (B.P. 60^{o} C- 80^{o}C) as a solvent. Crude fiber was determined by acid-base digestion with 1.25% H_2SO_4 (W/V) and 1.25% NaOH (W/V) solutions.

(1) Available carbohydrate(%)

Available carbohydrate (AOAC, 1990) was determined as follows:

Available carbohydrate(%) = 100- (crude protein+ crude lipid +crude fiber + ash) (1)

(2) Energy value (Kcal/100g)

According (Asibey – Berko and Taiye, 1999), energy value was estimated as follows:

Energy value (Kcal/100g) = (crude lipid x 9) + (crude protein x 2) + (carbohydrate x 4) (2)

2.3 Samples preparation for mineral analysis

Six (6) gram of the powdered sample was weighed into a crucible and gently heated over a Bunsen burner until it charred. The charred sample with the crucible was transferred into a Lento muffle furnace at about 600^{0}C and content ashed until grayish white ash was obtained. It was cooled first at room temperature and then in a desiccator. 5 cm^3 of conc. HCl was added and heated for 5 minutes on a hot plate in a fume cupboard. The mixture was then transfer into a beaker and the crucible washed several times with distilled water. The mixture was made up to 40 cm^3 and boiled for 10 minutes over a bunsen burner. This mixture was then cooled, filtered into a 100 cm^3 volumetric flask and distilled water was used to rinse the beaker into the volumetric flask and solution made up the volume to 100 cm^3 Ceirwyn. (1995). The solution where prepared in triplicates.

2.4 Determination of minerals concentration

Sodium (Na) and Potassium (K) were analysed by flame atomic emission spectrophotometer with NaCl and KCl used to prepare the standards. Phosphorus (P) was determined with Jenway 6100 spectrophotometer at 420 nm using vanadium phosphomolybdate (vanadate) colorimetric method with KH_2P0_4 as the standard. Ceirwyn. (1995). The concentrations of calcium (Ca), magnesium (Mg), copper (Cu), Iron (Fe), Manganese (Mn) and Zinc (Zn) in the solutions were determined with Atomic Absorption Spectrophotometer AAS 969 (Bulk Scientific, MODEL VGP 210/211) AOAC (1990).

2.5 Nutrient density (ND)

The sample nutrient densities were calculated using the below equation (Cole,1980).

$$ND (\%) = \frac{[Np/Ep]}{[Nr/Er]} \times 100 \qquad (3)$$

Where Np = nutrient concentration (mineral element in the food) (mg/100g)

Ep = energy supplied by food (Kcal/100g)
Nr = recommended daily intakes of nutrient (mg/day)
Er = recommended energy intake (3000 Kcal/day for an adult male given by WHO/FAO

2.6 Contribution to RDA(%)

Contribution to RDA was estimated according to NRC (1989) as follows:

$$= \frac{\text{Concentration of the elements}}{\text{RDA}} \times 100 \qquad (4)$$

Where RDA = recommended dietary allowance

2.7 Data analysis

Data were generated in triplicates and the mean standard deviation determined according to Steel and Torrie (1980).

3. Result Analysis

3.1 Proximate composition

The proximate composition of the leaves of *Rumex acetosa* is presented in Table 1. As with most fresh leafy vegetables, the leaves have high moisture content (87.47 ± 0.42%). This value is low compared to 88.33 ± 1.30% found in *Corchorus olitorius* leaves Idris et al.(2009).

The sample ash content of 10.18 ± 0.01% indicate that the leaves could be a good sources of mineral since the ash content of any sample is an index of mineral contents.

Protein act as enzymes, hormones, and antibodies. They maintain fluid balance and acid base balance Protein (2010). The crude protein content (3.70 ± 0.19%) for this leaves revealed that they are poor sources of protein.

The crude lipid content of the leaves of *Rumex acetosa* was found to be 9.78 ± 0.75% dry weight. This value showed that the leaves of *Rumex acetosa* are poor source of plant lipid, which is in agreement with general observation that leafy vegetables are low lipid containing food, thus advantageous health wise to avoid over weighting Lintas (1992).

Consumption of fiber containing food materials can stimulate weakening hunger, stimulating peristaltic movement and increasing excretion of bile acids Gorecka et al. (2000).The fiber content of the leaves of *Rumex acetosa* was found to be 12.53 ± 0.01% which implies that leaves of *Rumex acetosa* are poor sources of plant fiber.

Main function of carbohydrate in the body is for energy supply. Higher carbohydrate content of 63.81 ± 0.18% in the leaves of *Rumex acetosa* give rise to higher energy value of 350.66 ± 0.27 Kcal/100g in the sample. This findings indicated that the leaves of this plant are good energy sources.

3.2 Mineral content

Table 2 showed the mineral composition of the leaves of *Rumex acetosa.* Potassium is an essential mineral which must be consumed in the diet. It is vital for proper nerve excitation and contraction in muscular tissues Potassium (2010). Higher potassium content of 2132.85 ± 3.52 mg/100g in the leaves of *Rumex acetosa* revealed that the leaves of this plant are good diets for hypertensive patient since any diets rich in potassium can reduce the risks of hypertension and possibly strokes.

Sodium is involved in cellular transportation occurring across membranes and necessary for the functioning of the cells and the body Sodium (2010). The leaves sodium content of 28.61 ± 0.48 mg/100g showed that the leaves of *Rumex acetosa* are poor sources of this mineral elements.

Table 1. Proximate composition of the leaves of *Rumex acetosa* .

Parameter	**Concentration (%Dry weight)**
Moisture content[a]	87.47 ± 0.42
Ash	10.18 ± 0.01
Crude protein	3.70 ± 0.19
Crude lipid	9.78 ± 0.75
Crude fiber	12.53 ± 0.01
Available carbohydrate	63.81 ± 0.18
Energy value (Kcal/100g)	350.66 ± 0.27

The data are mean values ± standard deviation (SD) of triplicates.
[a]Value expressed as % wet weight.

Table 2. Mineral composition of the leaves of *Rumex acetosa*

Mineral elements	**Concentration (mg/100g dry matter)**
K	2132.85 ± 3.52
Na	28.61 ± 0.48
Ca	53.25 ± 0.05
P	7.73 ± 0.07
Mg	73.56 ± 0.02
Cu	0.85 ± 0.04
Fe	10.81 ± 0.04
Mn	13.59 ± 0.04
Zn	2.66 ± 0.01

The data are mean value ± standard deviation (SD) of triplicates.

Calcium content in the leaves of *Rumex acetosa* was found to be 53.25 ± 0.05 mg/100g. Calcium is constantly being exchanged between the bones and the body fluids or even the soft tissues, where the remaining calcium is stored and utilized in various biochemical processes. This plant leaves could serve as a good diets for lactating mothers since as child is nursed, calcium is sourced from the mother via the breast milk Calcium (2010).

Phosphorus is important for healthy bones and teeth. It is important for the utilization of nutrients in the body and in order to release energy inside the cells. 7.73 ± 0.07 mg/100g was recorded as phosphorus concentration in the leaves of *Rumex acetosa*. According to Guil – Guerrero et al. (1998), for good calcium and phosphorus intestinal utilization, Ca/P ratio must be close to one. The leaves of *Rumex acetosa* had a high ratio (6.89). This shows that the leaves of *Rumex acetosa* are good sources of calcium over that of phosphorus; however, the diet based on this leaves required to be supplemented with other food material rich in phosphorus.

Magnesium is essential for energy production, protein formation and cellular replication. The leaves of *Rumex acetosa* contain 73.56 ± 0.02 mg/100g of magnesium which indicates that it is a poor source of this mineral element.

The concentration of copper in this sample was recorded as 0.85 ± 0.04 mg/100g. Copper is important for infant growth, brain development and for strong bones. From the result, the leaves of *Rumex acetosa* are moderate source of copper relative to it's recommended dietary allowance (RDA) of 1.5 – 3 mg/day for adult male and female, pregnant and lactating mothers and 1 – 3 mg/day for children (7 – 10 years) NRC (1989).

Iron is essential for metabolism, growth, healing, immune function, reproduction and as a cofactor in many enzyme reactions. The iron content in the leaves of *Rumex acetosa* was 10.81 ± 0.04 mg/100g. The leaves of *Rumex acetosa* are good sources of iron compared to the RDA for iron which is 10 -15 mg/day NRC (1989).

Manganese acts as activator of many enzymes. The Mn content of 13.59 ± 0.04 mg/100g in the leaves of *Rumex acetosa* clearly indicated that the plant leaves are good source of manganese compared to the RDA for Mn which are 2 – 5 mg/day for adult male and female, pregnant and lactating mother, 2- 3 mg/day for children (7 – 10 years) NRC (1989).

The leaves of *Rumex acetosa* contain 2.66 ± 0.01 mg/100g of zinc. Zinc is involved in normal function of immune system. From the result, the leaves of *Rumex acetosa* are moderate source of this mineral element compared to it's RDA of 12 – 15 mg/day NRC (1989).

3.3 Contribution to RDA

The contribution of mineral elements by the leaves of *Rumex acetosa* to the dietary intake was evaluated and presented in Table 3. The leaves were rich source of potassium, iron and manganese, moderate source of magnesium, copper and zinc and poor source of sodium, calcium and phosphorus when compared to their respective recommended dietary allowances. This indicated that the leaves supplement other dietary sources of potassium, iron, manganese, copper, magnesium and zinc.

3.4 Nutrient density

Nutrient density (ND) is the index of nutrition quality used to evaluate the nutritional significance of mineral elements and presented in Table 4. Food materials with ND of 100% supply the nutrient needed in the same proportion as the calorie needed which implies that potassium, magnesium, copper, iron, manganese and zinc made the supply.

Table 3. Contribution of mineral elements by the leaves of *Rumex acetosa* to the dietary intake

Minerals	RDA (mg)	Contribution to RDA (%)
K	2000	107
Na	500	6
Ca	1200	4
P	1200	1
Mg	350	21
Cu	1.5 – 3	28 – 57
Fe	10 – 15	72 – 108
Mn	2 – 5	272 – 680
Zn	12 – 19	14 – 22

Table 4. Nutrient density of mineral element in the leaves of of *Rumex acetosa*

Minerals	RDA (mg)	Nutrient density (%)
K	2000	1400
Na	500	75
Ca	1200	58
P	1200	8
Mg	350	276
Cu	1.5 – 3	370-740
Fe	10 – 15	946-1433
Mn	2 – 5	3500-8500
Zn	12 – 19	184-290

4. CONCLUSION

Proximate and mineral composition of the leaves of *Rumex acetosa* was conducted using standard analytical methods. The result of these findings revealed that the leaves of sorrel are good source of available carbohydrate and energy values. They are also good source of potassium, iron and manganese and moderate source of magnesium, copper and zinc compared to their contribution to RDA respectively. Thus, optimal utilization of the plant will help toward realizing a better nutritional standard of the inhabitants who eat the plant.

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REFERENCES

1. [1] Abdullahi M, Muhammad G, Abdulkadir NU. Medicinal and economic plants of Nupeland. Jube Evans publisher, Bida, Niger state,1st Edition 2003: 153.
2. [2] Sorrel. Wikipedia, the free encyclopedia, retrieved on 27thJune, 2010. File://\\system1\c\sorrel-Wikipedia, the free encyclopedia.htm
3. [3] AOAC. Official Methods of Analysis, Association of official Analytical Chemists,Washington DC. 14th Edition. 1990.
4. [4] Ceirwyn SJ. Analytical Chemistry of Food. Chapman and Hall publisher, London, 1995:76 – 77.
5. [5] Asibey – Berko E, Taiye FAK. Proximate analysis of some underutilized Ghanain vegetables. Ghana Journal of Science 1999; 39:91 – 92.
6. [6] Cole AH. Energy expenditure and energy requirements in Nigeria. Nigerian Journal Of Nutritional Sciences 1980;1(2) :204-207
7. [7] National Research Council, NRC. Recommended dietary allowances, National Academy Press, Washington DC. 1989.
8. [8] Steel RGD, Torrie JH. Principles and procedures of statistics – a biometrical approach McGraw – Hill Book CoY. NY, USA. 3rd edition, 1980.
9. [9] Idris S, Yisa J, Ndamitso MM. Nutritional compositional of Corchorus olitorius leaves. Animal production Research Advances 2009; 5(2):83 – 87.
10. [10] Protein. Retrieved on 18th September 2010. http://www.herbs2000.com/protein.htm
11. [11] Lintas C. Nutritional aspects of fruits and vegetables consumption. Options Mediterraeennes 1992;19:79-87
12. [12] Gorecka D, Lampart-Szczapa E, Janitz W, Sokolowska B. Composition of Fraction of lupines (L.luteus and L. albus). Nahrung Food 2000; 44:229-232
13. [13] Potassium. Retrieved on 18th September 2010.http://www.herbs2000.com/minerals/potassium.htm
14. [14] Sodium. Retrieved on 18th September 2010. http://www.herbs2000.com/minerals/sodium.htm

15. [15] Calcium .Retrieved on 18th September 2010. http://www.herbs2000.com/minerals/calcium.htm
16. [16] Guil – Guerrero JI, Gimenez – Gimenez A, Rodriguez – Garcia L, Torija – Isasa ME. Nutritional composition of Sonchus species (S.asper L., S.oleraceus and S.tenerrimus L.). Journal of Science Food and Agriculture 1998; 76: 632.

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