



Research Paper

THE EFFECT OF BOILING ON THE PHYTOCHEMICAL AND NUTRITIONAL CONTENT OF RAUVOLFIA VOMITORIA

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Abstract

The phytochemical and proximate composition of *Rauvolfia vomitoria* leaves was carried out. *R. vomitoria* is a species of flowering plants belonging to the Apocynaceae family and is commonly known as swizzle stick, Africa Snake root and poison devils paper. A multistage sampling procedure was used to collect data on phytochemical and proximate composition which were analyzed using descriptive and cross tabulation. The result of the phytochemical and proximate composition of *R. vomitoria* leaves, boiled at intervals of 3,5,8,12 and 15minutes in addition to unboiled sample represented as (Raw) were analysed using standard analytical methods. The result obtained from this study revealed that this leave samples under study contain crude protein ranging from (20.38± 0.03 to 23.56±0.10).The values of ash ranges from (11.26±0.03 to 12.73±0.02),for proximate together with crude fibre, moisture and fat extract. It also revealed the presence of minerals in the leave samples, showing a reduction in the minerals as boiling increases with time, Calcium ranging from (324.77±0.07 to 258.72±0.01),Iron(fe) values ranging from (4.79 to 2.85).It also revealed the presence of vitamins, which include Vitamin A,B1,B2,B3 and C as they were reduced as boiling increases, Vitamin A values ranging from (228.19 to 236.78) ,B1ranging from (0.65 to 0.32).Phytochemical screening of this leaves also revealed the reduction in the level of bioactive compounds as boiling time increased, Saponin ranging from (1.52 to 0.28),Tannin ranging from (1.63 to 0.27).With these minerals, vitamins and bioactive compounds present in *R.vomitoria* leave samples revealed that *R.vomitoria* leaves have a lot of medicinal potential in curing and preventing ailments like Malaria, Typhoid and Jaundice among others.

Key words: *Rauvolfia vomitoria*, Phytochemical, Medicinal.

INTRODUCTION

Rauvolfia vomitoria is a species of flowering plants belonging to the Apocynaceae family and is commonly known as swizzle stick, Africa Snake root and poison devils paper; this plant originated majorly from Africa and is distributed in the dry regions of the continent such as

West Africa. It is found in Lagos, Abeokuta, Ibadan and in the Eastern part of the country [20]. *Rauvolfia vomitoria* was described by Afam Afzelius in 1818, hence, the name is considered as validly published. This plant is a species in the genus *Rauvolfia* which contains approximately 77 to 86 species. The shrubs reach heights of 4m to 5m with wood, bark and leaves. *R. vomitoria* is ever green, the simple leaves are whorled, and they are ovate with entire margins. Over the years *Rauvolfia vomitoria* has been generally considered as weed but in recent times quite a number of investigations and reports have confirmed the diverse uses of this species in some countries of the world.

On the other hand, phytochemicals are bioactive, non-nutrient plant compounds in fruits, vegetables, grains and plant food that have been linked to reducing the risk of major degenerative disease [17]. [15] Defined phytochemicals as plant derived chemicals, which are beneficial to human health and disease prevention. Phytochemicals are thought to be responsible for much of the disease protection granted by diet high in fruits, vegetables, beans, cereals, hence, phytochemicals are strong anti-oxidant and has been found useful in the management and/or treatment of the following disease such a obesity, a risk factor for cardiovascular disease, cancer and diabetes [7].

More so, there have been several reports on the medicinal values of *Rauvolfia vomitoria* in local folk's medicine of various parts of the world. In using *Rauvolfia vomitoria* for treatment, it can be administered in several forms: a root decoction, root macerate or powdered root in water is taken to treat diarrhea, rheumatism, jaundice, venereal diseases and snakebites [3]. Root products are also widely taken to treat hypertension, and as a sedative to calm people with epilepsy, and people who are psychotic or mentally ill, they are also used to wash children with Colic or fever [16].

Externally, macerated or powdered root or sometimes pulped fruit are applied to a range of skin problems, such as rash, pimples, chicken pox, wounds, scabies, psoriasis, leprosy, hemorrhoids, head lice and parasitic skin diseases. A root decoction is used as a mouth wash against *gingivitis* or thrush [14]. The stem bark or leaves are also used for these purposes; leaf decoction and latex of young twigs are widely used as purgative or emetic [9]. Dried or fresh pulverized roots in palm wine or oil are taken to treat female sterility [4]. A root decoction is used in massages and baths to treat rheumatism, tiredness and rachitis. Also, pulverized root bark in brandy is taken to treat tuberculosis [10]. Decoction of powdered roots is taken to treat diabetes and malaria [14].

MATERIALS AND METHODS

SOURCES OF MATERIALS

The leave sample of *R. vomitoria* were collected from Onuebonyi Izii Local Government Area, Ebonyi State Nigeria; which lies between (6.15°N, 8.5°E) and it occupies a land area of 20,570km, with annual rainfall of 1,300mm and an average temperature of 30°C. These leave sample was obtained from forest regrowth where fallow periods are prolonged. The leaves samples were identified by Prof. J. C. Okafor of Applied Biology Department, Ebonyi State University.

SAMPLE PREPARATION

The plant samples were cleaned of dirt and insect larvae. The leaves were washed and spread on a mat, they were dried under the sun until they turned brittle and crispy enough to mill. Milling was done manually with pestle and mortar to obtain powdered samples needed for analyses. The second sample of the same plant was boiled at 3minutes, 5minutes 8minutes, 12minutes and 15minutes, they were labeled as B, C, D, E, and F respectively. Afterwards, they were dried; grinding was done manually with pestle and mortar to obtain powdered samples needed for analysis. Each pulverized vegetable sample was stored in labeled clean dry container and kept in a cool dry place prior to analyses.

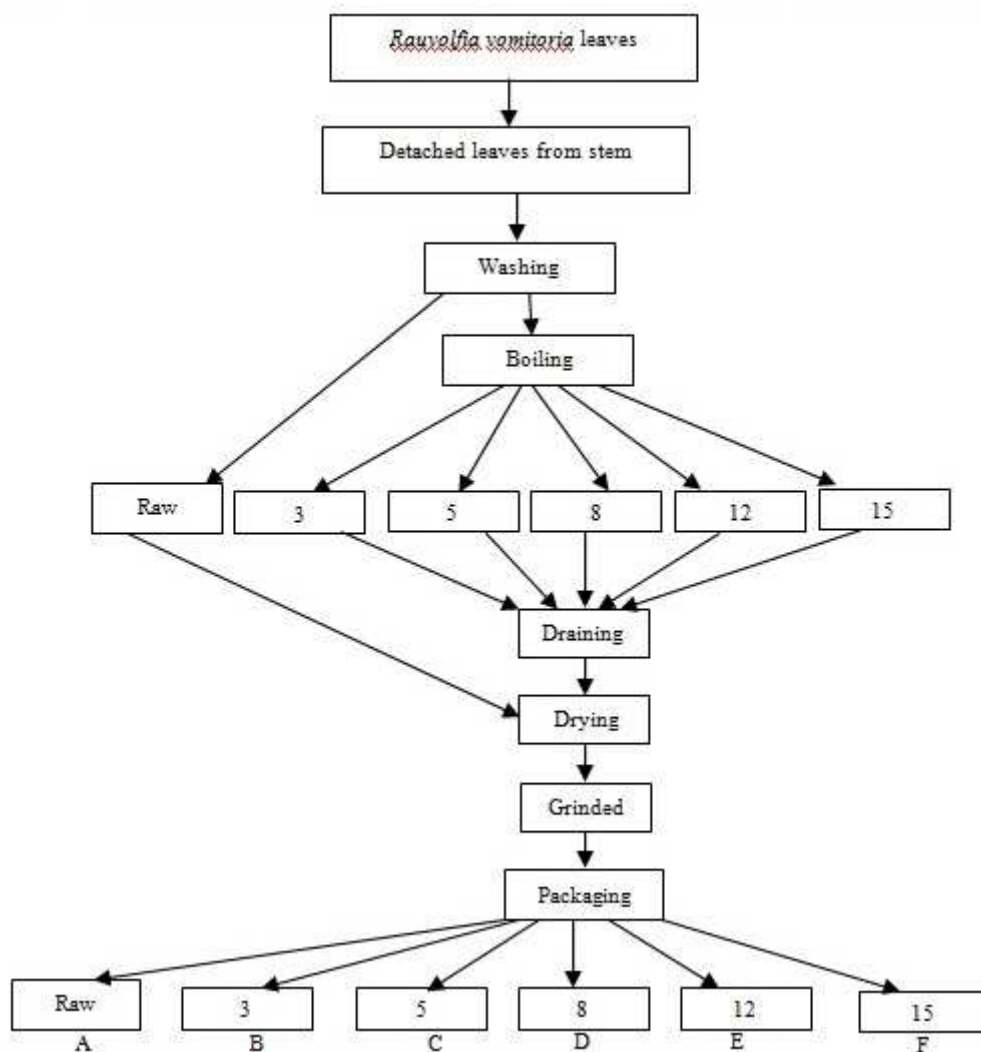


Fig 1: Flow chart for sample preparation of *Rauvolfia vomitoria*

PROXIMATE ANALYSES

Determination of protein

Different methods by different authors were employed in carrying out the proximate analyses and they include: Semi-micro Kjeldahl Method described by [12] for the protein determination; Continuous Solvent Extraction Gravimetric Method using Soxhlet Apparatus, as described by [6] was used to determine the fat content in the plant sample; also, the crude fiber content was determined using the Wended Method described by [1]. Furnace Incineration Gravimetric Method described by [1] was used to check for the total ash content; Moisture content of was determined gravimetrically as described by [2] with the formula below: % moisture = $\frac{W2}{w2} - \frac{W3}{w1} \times \frac{100}{1}$
%dry matter = 100- % moisture content

Where:

W1 = Weight of empty moisture can

W2 = Weight of can before drying

W3 = Weight of can + sample after drying to a constant weighed.

The carbohydrate content was determined by calculating the difference of Nitrogen Free Extractive (NFE), a method described by [11]. It was given as the difference between 100 and a sum total of the other proximate components. Hence it was calculated using the formula below
% CHO= 100 -% (protein + fat + fibre + Ash + Moisture content)

DETERMINATION OF MINERALS

The mineral content of each sample was determined by the Dry Ash Extraction Method described by [6].

PHYTOCHEMICAL SCREENING

For the phytochemical screening, alkaloids was determined using the alkaline precipitation gravimetric method described by [1]; flavonoids in the leave was determined using the method described by [5]. The emulsion test method as described by [1] was used to determine the presence of saponins, where tannin was determined using the colorimetric method described by [8]. Presence of phenols was determined using method described by [2]. More so, phytate and HCN was determined using the method described by [19]. Presence of oxalate was determined by the method described by [2].

DETERMINATION OF VITAMINS

Vitamin A (Retinol) was determined using method described by AOAC (1990). Vitamin B (Thiamine), Vitamin B₂ (Riboflavin), Vitamin B₃ (Niacin) and Vitamin C (Ascorbic Acid) was determined using spectrophotometric, colorimetric, scalar colorimetric and basket titration methods respectively as described by [18].

RESULT

Proximate Analysis Result

Table 1: Result of Proximate Analyses on Leave of *R. vomitoria*

Sampl e code	Moisture content	Ash content	Crude fiber	Crude fat	Crude protein	Carbohydra te
A	10.85± 0.08	19.67±0.02	12.73±0.03	2.78±0.03	23.56±0.10	8.15±0.08
B	10.28±0.02	18.87±0.05	12.49±0.05	2.60±0.02	22.22±0.12	8.72±0.02
C	10.76±0.07	16.28±0.02	11.90±0.02	2.55±0.04	21.87±0.05	8.21±0.07
D	10.79 ±0.02	13.83±0.03	11.8±0.03	2.45±0.08	21.61±0.01	8.21±0.02
E	9.61±0.32	11.78±0.03	11.78±0.03	2.26±0.14	20.47±0.02	8.22±0.03
F	10.92±0.00	10.26±0.03	11.26±0.03	2.22±0.03	20.38±0.03	7.15±0.00

Sample code

A = Unboiled sample (RAW)

B = boiled sample at 3 minutes

C = boiled sample at 5 minutes

D = boiled sample at 8 minutes

E = boiled sample at 12 minutes

F = boiled sample at 15 minutes

The table above shows the proximate analyses result on *R. vomitoria* leaves boiled at intervals of 3, 5, 8, 12 and 15minutes respectively and then the unboiled sample represented as (Raw). The table revealed that the highest proximate constituent was the crude protein found in the raw sample (23.56±0.10) while the least was the crude fat (2.22±0.03) found in the leave sample boiled for 15minutes. The table however, shows that there is a decrease in the proximate value of the leaves of *R. vomitoria* as boiling increased.

Table 2: Result of Mineral Content Analyses on Leave of *R. vomitoria*

Sample code	Ca	Mg	Na	Fe	K	P
A	324.77±0.01	165.85±0.01	137.76±0.03	4.79±0.02	276.86±0.03	178.26±0.03
B	317.80±0.87	162.77±0.05	133.58±0.02	4.23±0.00	275.31±0.01	175.19±0.02
C	308.65±0.09	160.58±0.04	128.33±0.03	3.79±0.01	258.69±0.02	172.32±0.03
D	296.57±0.09	154.65±0.04	126.58±0.21	3.79±0.01	258.69±0.08	171.21±0.12
E	292.57±0.02	153.79±0.02	125.98±0.03	3.47±0.03	251.66±0.03	165.48±0.32
F	258.70±0.07	149.68±0.10	123.83±0.03	2.85±0.07	236.33±0.13	163.55±0.03

The table above shows the result of the analysis conducted on the mineral profile of *R. vomitoria* leaves boiled at intervals of 3,5,8,12 and 15minutes respectively, with the unboiled sample represented as (Raw). The highest mineral value was calcium (324.77±0.01) found in the raw sample while the least was iron (2.85±0.07) found in the leave sample boiled for 15minutes. This therefore, revealed that the quantity of minerals in *R. vomitoria* leave was decreased with increased period of boiling, hence, the indicating the loss of minerals.

Table 3: Result of the Vitamin Content on the Leave of *R. vomitoria*

Sample code	B1	B2	B3	A	C
A	0.65±0.00	0.44±0.01	1.11±0.03	236.78±0.03	0.57±0.05
B	0.53±0.01	0.39±0.00	1.05±0.00	235.84±0.03	0.48±0.00
C	0.49±0.00	0.36±0.03	0.93±0.01	232.77±0.06	0.45±0.00
D	0.42±0.00	0.29±0.01	0.88±0.03	230.61±0.27	0.39±0.02
E	0.39±0.00	0.24±0.01	0.79±0.02	230.57±0.02	0.28±0.02
F	0.32±0.00	0.19±0.01	0.56±0.02	228.19±0.02	0.18±0.00

The table above shows the result of vitamin composition of *R. vomitoria* leave samples boiled at intervals of 3,5,8,12 and 15minutes respectively, with the unboiled sample represented as (Raw), vitamin A (Retinol) was found to be the highest vitamin present in the leave of *R. vomitoria* (236.78±0.03), the least was however, found in the leave samples boiled for 15minutes. Also the value of vitamins was reduced as boiling increased.

Table 4: Result of Phytochemical Analyses on Leave of *R. vomitoria*

Sample code	Alkaloid	Flavonoid	Phytate	Tannin	Phenol	Saponin	HCN	Oxalate
A	1.88±0.23	2.78±0.03	1.35±0.01	1.63±0.00	0.24±0.01	1.52±0.04	6.68±0.20	0.18±0.00
B	1.62±0.00	1.91±0.02	0.94±0.00	1.2±0.20	0.20±0.01	1.25±0.00	4.17±0.02	0.15±0.00
C	1.45±0.00	1.56±0.02	0.82±0.00	1.08±0.00	0.12±0.00	0.84±0.00	3.36±0.02	0.13±0.01
D	1.29±0.00	1.18±0.00	0.65±0.00	0.85±0.00	0.09±0.00	0.29±0.01	1.43±0.00	0.09±0.00
E	0.85±0.00	0.92±0.00	0.39±0.00	0.57±0.00	0.06±0.00	0.55±0.00	1.29±0.00	0.06±0.00
F	0.39±0.00	0.44±0.01	0.12±0.00	0.27±0.00	0.47±0.00	0.28±0.01	0.77±0.01	0.00±0.00

The table above shows the result of the phytochemical composition conducted on the leaves of *R. vomitoria* boiled at 3, 5, 8, 12 and 15minutes respectively and the unboiled sample represented as raw. The table however, revealed that glycosides (HCN) had the highest phytochemical value (6.68±0.20) found in the raw sample while the least phytochemical value was oxalate found on the leave sample boiled for 12minutes (0.06±0.00). More so, there was no

oxalate found on the leave sample that was boiled for 15minutes. This therefore, depicts that phytochemical content of the leaves was reduced in due to increased boiling.

DISCUSSION

There have been several reports on the medicinal values of *Rauvolfia vomitoria* in local folk's medicine of various parts of the world and this could be attributed to the phytochemical content, the proximate content, the mineral and vitamin contents respectively. According to [15] phytochemicals are plant derived chemicals, which are beneficial to human health and disease prevention. In table four, the result of the phytochemical composition conducted on the leaves of *R. vomitoria* which were boiled at 3, 5, 8, 12 and 15minutes respectively and the unboiled sample represented as raw, showed that as boiling time increased, the phytochemical contents in the leaves decreased. Work by [23] reported an appreciable loss in the phytochemical content of Soyabean after boiling. The table however, revealed that glycosides (HCN) had the highest phytochemical value (6.68 ± 0.20) found in the raw sample while the least phytochemical value was oxalate found on the leave sample boiled for 12minutes (0.06 ± 0.00) and there was no oxalate found on the leave sample that was boiled for 15minutes. This therefore, depicts that phytochemical content of a plant part could be lost totally if it is subjected to prolonged boiling.

On the other hand, the proximate content result was shown in table one and crude protein content was seen to be the highest proximate content found on the raw sample and which was seen to be reduced reasonably with an increase in boiling period, this could however, be as a result of leaching of free amino acids due to boiling, hence suggesting that boiling has deleterious effects on the protein content of *R. vomitoria* leaves. This also confirms the work of [22] on *Melatheca scavens* and *Lea guinensis*. Although the presence of these proximate constituents, mineral and vitamin values on the leave of *R. vomitoria* suggests its high nutritional value and relevance. Adequate intake of fibre reduces the risk of heart disease, constipation, hypertension, breast cancer, and lowers cholesterol level. Phytate in food are known to bind with essential minerals such as calcium, iron, magnesium and zinc in the digestion tract resulting in mineral deficiencies. They bind minerals to form insoluble salts thereby decreasing their bioavailability or absorption. Tannins reduce the digestibility of food protein. Alkaloids are the most efficient; they are centrally significant plant substance. Alkaloids are used because of their analgesic, antispasmodic and antibacterial properties [21]. Hydrogen Cyanide is toxic when digested by monogastric animals in large quantity. The levels of these antinutrients and cyanide soaking of plant materials or boiling in water is said to reduce toxic effects and improves utilization in terms of feed intake and protein digestibility. Vitamin B complexes play important roles in vision, vitamin B1 indicated for healthy skin, B2 and B3 indicated for cellular metabolism [13]. Vitamin C helps in fighting scurvy, which assists in manufacturing of collagen which holds bones together

The result obtained from this research shows that the leaves of *R. vomitoria* contain appreciable amount of protein, fat, fibre, carbohydrate and mineral elements, vitamins and generally low level of toxicants like cyanogenic glycosides which are much reduced due to increase in boiling. Boiling tends to reduce the amount of nutrients present in the leave sample as seen in the tables above which revealed the effect of boiling on crude protein, fat content, crude fibre, ash content and carbohydrate, although in moisture content, there was fluctuation in the result which indicated that boiling has little or no effect on the moisture content of *R. vomitoria* leave sample. However, it can be concluded that the leave of *R. vomitoria* can contribute significantly to the nutrient requirement of man and should be used as a source of nutrients supplement. The leaves of *R. vomitoria* were observed to contain significant quantities of saponin, cyanide, though moderate levels, suggesting that they may not be harmful to the user. They were also observed to contain high quantities of alkaloid and flavonoid suggesting their antioxidant potentials and thereby justifying their therapeutic uses in drug formation. The low quantities of tannin and phenol in the leave sample suggest that the usage of these leaves in herbal medicine can neither interfere with dietary iron absorption nor inhibit digestive enzymes. However the medicinal potential of *R. vomitoria* revealed from this study will help to preserve our cultural medicinal heritage and its impact will invariably be useful for the future

development of our traditional medicine. It is therefore recommended that sustainable management and domestication of *R. vomitoria* be ensured for posterity; in the same vain preservation techniques of the harvested parts must be intensified to avoid quick spoilage. Since it has been observed that the leaves of *R. vomitoria* has more value at the raw state and decreases as boiling increases, tea made in form of infusion from the leave sample should be recommended for consumption as it tends to be safer and less concentrated. However further research work should be done on the phyto-toxicity of *R. vomitoria*.

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