



An Analysis of Food Value and Some Selected Secondary Metabolites of *Emilia coccinea* (Asteraceae) Leaf

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Authors' contributions

This work was carried out in collaboration between all authors. Author ANV designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors SCU, FCE and GNE managed the experimental process. Authors BICB and FOS assisted in design protocol and analysis. Authors FAO and CSE assisted in literature searches. All authors read and approved the final manuscript.

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ABSTRACT

It has been established that plants are good sources of food and medicine. In recent time, quest for greater knowledge and scientific novelty have led scientists to start paying more attention to minor constituents of food and food plant materials looking for "natural products" with healing powers. This study is an attempt to evaluate the proximate composition, constituents of trace elements, heavy metals, percentage yield of crude extracts/fractions and qualitative identification of phytochemicals in *E. coccinea* dried leaf. Proximate analysis employed standard analytical

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techniques of Association of Official Analytical Chemists. Mineral elements were analyzed using Atomic Absorption and X-ray Fluorescence spectroscopies. Tannin, saponin, steroid, alkaloid, reducing sugar, flavonoid and phenol identifications were done using standard analytical techniques. The proximate results indicated that the plant leaf contained high crude fibre content (13.39%) and carbohydrate (66.52%). The mineral elements showed that Calcium (241.78 g/kg), Potassium (46.21 g/kg), Sodium (2.85 g/kg), Magnesium (1.24 g/kg) and Manganese (0.73 g/kg), were the most abundant mineral elements in the leaf sample. This was followed by Zinc, Rubidium, Iron, Nickel, Selenium, Titanium, Copper, Cobalt and Chromium in the range of 0.0014 to 0.28 g/kg. Lead (Pb) was not detected. The phytochemical screening showed the presence of tannin, saponin, steroid, alkaloid, reducing sugar, flavonoids and phenols. These results suggest that the plant leaf is a source of nutrients, mineral elements and phytochemicals. The absence of Lead showed that the plant leaf will not constitute a health hazard for consumers. However, these results justify the wide traditional uses of this plant leaf as food and medicine.

Keywords: *Emilia coccinea*; food value; phytochemistry; extraction.

1. INTRODUCTION

Generally, plants serve various purposes and their usefulness can be in the form of food and phytomedicine. Later is attributed to phytochemicals' composition or secondary metabolites of the plants and their functionality on human system. Secondary metabolites which are considered to be non-essential for the life improves nutrient availability (e.g., in the form of chelating agents such as siderophores), by protecting against environmental stressors (e.g., pigments and osmoprotectants), by enhancing competitive interactions with other organisms (e.g., antibiotics, but also various signalling molecules), or by acting as a metabolic defence mechanism (e.g., many plant flavonoid and alkaloid toxins) [1]. The main objective of the chemists in the 18th and 19th centuries was to understand the nature of food. Thus, the first components of food to be studied were the main constituents among which were carbohydrates, fats, and proteins. But as time progressed, chemists started to pay attention to minor constituents of food and food plant materials looking for "natural products" with healing powers.

Functional foods are foods with secondary metabolites which may offer many benefits such as [2]:

- Increase in health value of our diet.
- Help us live longer.
- Help us to avoid particular medical conditions.
- Have a psychological benefit from doing something for oneself.
- Are more natural and less likely to produce unpleasant side-effects.

In addition, many secondary metabolites are widely used as active drug ingredients in medicine (e.g., many antibiotics, antitumor agents and antivirals are derived from secondary metabolites, as are antipyretics like aspirin, hallucinogenics like LSD, and cholesterol-lowering drugs like lovastatin, as herbicides or phytotoxins in agriculture, as food additives (colour, flavours and sweeteners), fragrances, and even as precursors for the synthesis of plastics [1]. Natural products research is one of the main means of discovering bioactive compounds with a potential to new drug discovery. The medicinal value of plants lies in some chemical substances that produce a definite physiological action on the human body [3]. Herbs and herbal formulations for the treatment of ailments have continued to receive increased attention because of the strong belief that these products are safe [4,5]. The therapeutic properties of medicinal plants used by traditional medical practitioners may be due to one or more of the many bioactive compounds of the plant material. These phytochemicals include complex carbohydrates, alkaloids, glycopeptides, terpenoids, tannin, saponin, peptides and amines, steroids, flavonoids, lipids, coumarins, sulphur compounds and inorganic ions among numerous others. Herbal plants are being increasingly utilized to treat a wide variety of clinical diseases [6]. Herbs have been used by all cultures throughout history and thus, herbal medicine is the oldest form of health care known to mankind. It was an integral part of the development of modern civilization. Many drugs commonly used today are of herbal origin, for example some are made from plant leaves, roots, barks, stems, fruits, nuts and seeds. The Garcina tablet sold in Nigeria is made from a plant nut. And it is highly medicinal, its functions go beyond modulating immune system function

and it is also anti-inflammatory. Higher plants as source of medicinal compounds continue to play a dominant role in maintenance of human health [7]. The primary benefit of using plant derived-medicine is that they are relatively safer than synthetic alternatives, offering profound therapeutic benefits and affordable treatment [8]. *E. coccinea* (Sims) G. Don belongs to the family Asteraceae. The members of this family are largely woody herbs or shrubs, a few trees and climbing herbs [9]. *E. coccinea* is also known as "tassel flower". It is an erect bushy herb of up to 120cm in height. It is a ubiquitous weed in wastelands and fallow fields. *E. coccinea* (Sims) G. Don is commonly found throughout the plain of the Central Africa and in dry areas up to 2000 m altitude in the eastern Africa. This specie belongs to the genus *Emilia* represented by above 100 species, with 50 of them found in Africa [10]. This paper reports a prospective investigation into proximate composition of *E. coccinea* dried leaf, trace elements constituents, heavy metals, proportions of crude extracts/fractions, and qualitative identification of phytochemicals.

2. MATERIALS AND METHODS

2.1 Plant Material Collection

The leaves of *E. coccinea* were harvested from a family compound in Alor community, Eastern Nigeria. Fig. 2 shows the GPS location of the *E. coccinea* plant leaf collected and used for this study. The place is less polluted because of no existence of industrial activities within the collection site. The leaves were washed and air dried. Dried leaves were blended to fine powder prior to different analysis.

2.2 Proximate Analysis

The proximate composition of *E. coccinea* dried leaf was determined using the standard analytical techniques of Association of Official Analytical Chemists (A.O.A.C.) [11].

2.2.1 Ash content

Platinum dishes used were cleaned, dried, ignited, cooled (in a desiccator) and weighed (W1). Five grams of sample was weighed accurately and placed in dish (W2). The sample in the dish was then transferred using a pair of tongs into a muffle furnace Argenta at 550°C until it was fully ashed (1 hour). The dish with ash

was then cooled in a desiccator and weighed (W3).

The % ash content was calculated using the formula:

$$\% \text{ Ash content} = \frac{W_3 - W_1}{W_2 - W_1} \times 100$$

2.2.2 Moisture content

The method used was based on loss on drying in an oven temperature of 105°C. Besides water, the loss included volatile matter at 105°C. Clean flat platinum dishes were dried in an oven and cooled in a desiccator, and the cooled dishes were weighed (W1). About 5 grams of sample was introduced and spread into the dish, and weighed accurately (W2). The dish and its contents were transferred into an air-oven and dried at 105°C to dry for about 3 hours. Using a pair of tongs, the dish was transferred into a desiccator, allowed to cool, and then weighed. The dish was returned to the oven for half an hour and again cooled in the desiccator and weighed. This process was repeated to constant weight (W3).

$$\% \text{ Moisture content} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

This value is the same as (a) % Loss on drying or

(b) % Matter volatile at 105°C

2.2.3 Protein content

Protein content of the plant leaf was determined using the Macro Kjeldhal Method. Exactly 1 gram of sample was weighed and transferred into Kjeldahl digestion flask and 25 ml of concentrated sulphuric acid was added to the flasks. Two tablets (2 g) of Mercury catalyst and 30 ml conc. H₂SO₄ acid were then added. The flasks were heated gently in a fume cupboard in an inclined position, using a heating mantle. The flasks were swirled occasionally. The heating and continual digestions were increased until the liquid was clear and free from black or brown colour.

The flasks were swirled from time to time to wash down charred particles from the sides of the flasks.

The boric acid mixture was titrated with 0.1N H₂SO₄ acid in order to determine the amount of Nitrogen that was trapped.

$$\% \text{ Nitrogen} = \frac{\text{Titre} \times 0.014}{\text{Wt. of sample}} \times 100$$

Where:

Titre- titration value
 Wt- weight of the sample
 0.014- Nitrogen factor
 $\% \text{ Crude Protein} = \% \text{ Nitrogen} \times \text{Protein Factor (6.25)}$

2.2.4 Total lipids content

Crude fat was estimated by continuous extraction with either light Petroleum or n-hexane over a period of time in a soxhlet type of apparatus. Sample with high protein content was treated with a strong acid (4N HCl) solution to liberate fat by dissolving the protein.

2.2.4.1 Procedure

Five grams of sample was weighed in a pre-weighed 250 ml-conical flask. A strong acid equivalent to 50 ml of 4N HCl was added and reflux for 2 hours using an air condenser. It was cooled slightly and filtered through an ashless filter paper. The residue was washed with warm distilled water until free from the acid. The residue of the paper was dried in a dessicator overnight.

Thereafter, the filter paper was wrapped neatly and put into a thimble of appropriate size. The thimble was put inside soxhlet extractor which was attached to a weighed, cleaned flask containing about 60 ml of ether (60°C). The flask was heated on a heating mantle while the extractor was connected to a condenser with running water. Through these connections, the fat was extracted from the leaf sample into the flask. The extraction was left to continue for 5 hours to ensure complete extraction.

The thimble was removed and the solvent was recovered from the flask into the extractor. The recovery was continued until the flask was almost free of the solvent. The flask and its fat residue were dried in an oven at 105°C for one hour. It was removed and cooled in a dessicator and weighed. When the extractor was nearly full, it was disconnected.

Percentage fat extracted was calculated as:

$$\% \text{ Crude fat (fat extracted)} = \frac{W2-W1}{W} \times 100$$

Where:

W-weight of sample (g)
 W1-weight of flask (g)
 W2=weight of flask + fat (g)

2.2.5 Crude fibre content

Crude fibre is the organic residue left after subjecting the sample to acid and alkali treatment, which are to breakdown the inorganic components.

2.2.5.1 Procedure

Exact 0.5 g of Celite 545 was weighed into clean and well dried sintered crucible. It was taken into muffle furnace and cooled in a desicator. One gram (W1) of the leaf sample was weighed into the sintered crucible. The crucible with the sample was taken to Fibertech™ 2010 machine for digestion. The sample in the crucible was boiled with about 150 ml H₂SO₄ 1.25% for 30 minutes, drained and washed with about 100 ml de-ionized water. About 150 ml of NaOH 1.25% was dispensed into the crucible and boiled for another 30 minutes. The sample was washed again with de-ionized water, thereafter, the sample was transferred to a cold extraction unit machine where acetone (about 50 ml) was added to it to remove fat from the sample. The acetone was added and left for about 5-10 minutes before it was drained off. The crucible with the sample was sent into oven at 105°C for 3 hours. After drying, it was removed, cooled in a desicator and weighed as W2. The crucible with the sample was taken into the muffle furnace at 550°C and ashed for 3 hours. It was removed, cooled in a desicator and weighed as W3.

Calculation:

$$\% \text{ Crude fibre} = \frac{W2-W3}{W1} \times 100$$

Where:

W1- Weight of sample
 W2-Weight of dish + fibre
 W3-Weight of dish + fibre ash

2.3 Determination of Total Carbohydrate

Determination of nitrogen free extracts (carbohydrate content): Nitrogen Free Extract (NFE) was calculated by difference after

analysis of all the other proximate parameters [12].

$$\text{NFE} = (100 - \% \text{ moisture} + \% \text{ crude protein} + \% \text{ crude fat} + \% \text{ crude fiber} + \% \text{ ash})$$

2.4 Mineral Analysis

An exact amount of 1.0014 g of dried powdered *E. coccinea* leaf was weighed in a digital analytical balance. The sample was ashed in Argenta furnace at 550°C for one hour. Three drops of concentrated HNO₃ was added to the ash and it was made up to 100 ml. The aliquot was used for the determination of the mineral elements according to A.O.A.C. [11]. The reagent blank was prepared by adding three drops of concentrated HNO₃ into a volumetric flask and was made up to 100 ml. Cr, Ca, Mg, Cu, Zn, Mn, Pb, Cd and K were assayed using atomic absorption spectroscopy. Ti, Fe, Ni, Rb, Se, and Co were assayed using X-ray fluorescence spectroscopy according to the method described by [13].

2.5 Atomic Absorption Spectrophotometric (AAS) Method

AA-7000 Atomic Absorption Spectrophotometer SHIMADZU model equipped with hollow cathode lamp was used for the analysis of calcium, magnesium, iron, copper, zinc, cadmium, chromium, manganese and lead. The instrumental parameters were adjusted according to manufacturer's instructions, the hollow cathode lamps for selected minerals with respective wavelengths.

The concentration was calculated as:

$$\frac{\text{Conc (\%)}}{\text{WF}} = \text{DVR} \times 10^{-4}$$

Where:

- D-dilution factor (equals to 1)
- V-volume
- R-concentration from the calibration curve
- WF-weight factor

2.6 Extraction of Bio-agents from *E. coccinea* Leaf

Extraction of bioactive agents from *E. coccinea* leaf was done according to methods described by [14-17]. The dried ground *E. coccinea* leaf powder (1300 g) was soaked in 4L methanol at

room temperature (20°C-23°C) for 2 days. The content was labeled NV/L/1. NV/L/1, thereafter, filtered and concentrated using rotary evaporator. The methanol crude extract obtained was labeled MCE, the crop was re-soaked to get more methanol crude extract.

Percentage crude extract was calculated as follows:

$$\% \text{Yield} = \frac{\text{Weight of extract}}{\text{Weight of dried ground leaves}} \times 100$$

2.7 Solvent Partitioning of Methanol Crude Extract (Sequential Extraction)

Solvent partitioning of methanol crude extract (Sequential Extraction) was according to [14-17].

The methanol crude extract (MCE) was partitioned using both non-polar and polar solvent in order of increasing polarity starting with hexane followed by Dichloromethane (DCM) and Ethyl acetate solvents. The fractions obtained were hexane fraction/solubles (HF), Dichloromethane fraction/solubles (DF), Ethylacetate fraction/solubles (EF) and Aqueous-methanol fraction/solubles (AqMF). The weights of the concentrated fractions were recorded. The different fractions were used for qualitative phytochemical screening.

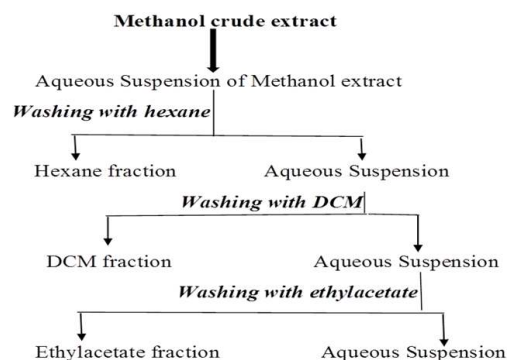


Fig. 1. Sequential extraction (Solvent partitioning) of methanol crude extract

2.8 Qualitative Phytochemical Analysis

2.8.1 Test for steroids

Steroid was tested by method described by [18], 5 ml sample of the extract was added to 2 ml acetic anhydride and 2 ml H₂SO₄. The colour change from violet to blue or green indicated the presence of steroids.

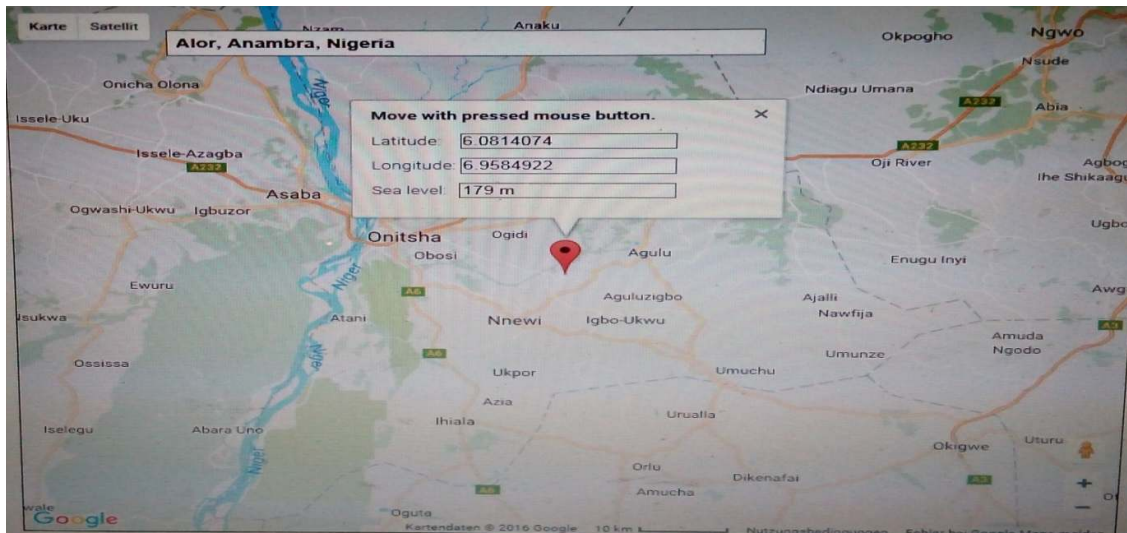


Fig. 2. The GPS location of the *E. coccinea* plant leaf

2.8.2 Test for reducing sugar (Fehling’s reagent)

Test for reducing sugar was done using Fehling’s reagent A. Two ml sample of the aqueous extract was boiled with equal volume of Fehling’s solutions A and B for 15 minutes. A brick red precipitate indicates the presence of reducing sugar and a 2 ml sample of the aqueous extract was boiled with 1 ml dilute HCl for 15 minutes, cooled and neutralised with dilute ammonia. The reaction mixture was then boiled with equal volume of Fehling’s solution A and B for 15 minutes to give a more intensive brick red precipitate that indicated the presence of glycosides [19].

Qualitative determination of tannin, phlobatanin, saponin, alkaloid, flavonoids, cardiac glycoside, and phenols were carried out using the methods of [20] with slight modification.

2.9 Data Analysis

Data were analyzed by expressing as mean ± standard deviation of triplicate determinations.

3. RESULTS AND DISCUSSION

3.1 Food Value of Dried *E. coccinea* Leaf

The proximate composition of *Emilia coccinea* leaf is shown documented in Table 1. The ash content which provides an estimate of the quality of the product was of the value of 6.18%. This is an indication of high mineral (especially the macro-minerals) content of the leaf. The leaf was high (13.39%) in crude fibre (Table 1). Crude

fibre measures the cellulose, hemicellulose and lignin content of food. Lignin comprises polymers of phenolic acids and hemicellulose is made up of hetero-polymers of polysaccharides [21]. High fibre content in diets have been reported to result in increased removal of carcinogens, potential mutagens, steroids, bile acids and xenobiotics by binding or absorbing them into dietary fibre components with rapid excretion. High fibre content, therefore, has health promoting benefits for the ruminants and non-ruminants [22]. The high carbohydrate content (66.52%) in *E. coccinea* authenticates its usefulness as a potential energy sources for animals and humans. The crude fibre, carbohydrate and ash contents are close to the values reported by Ubwa et al. [23]. The leaf is low in protein and fat. The protein content was 3.15%. Protein is an essential component of diet needed for survival of animals and human beings, their basic function in nutrition is to supply adequate amount of required amino acids. The fat content was 3.01% and the moisture content was 7.75% (Table 1).

Table 1. Proximate analysis of dried *E. coccinea* leaf

Composition	Values in %
Carbohydrate	66.52±0.16
Protein	3.15±0.03
Fat	3.01±0.06
Moisture	7.75±0.07
Ash	6.18±0.08
Crude fibre	13.39±0.39

All data were mean ± standard deviation of triplicate determinations

Table 2. Trace elements constituents of dried *Emilia coccinea* leaf using atomic absorption spectrophotometer

Trace elements	Conc. in mg/Kg	Calculated conc. in mg/100 g	Calculated conc. in g/100 g	Calculated conc. in g/kg
Cu	26.59±0.01	2.66	0.003	0.03
Mn	726.54±0.05	72.65	0.073	0.73
K	46207.52±0.05	4620.75	4.621	46.21
Mg	1242.49±0.02	124.25	0.124	1.24
Ca	241782.85±0.01	24178.29	24.178	241.78
Na	2848.02±0.01	284.80	0.285	2.85

Values reported are mean± standard deviation of triplicate determinations

Knowledge of the elemental content in medicinal plants is very important since many trace elements play significant roles in the formation of active constituents responsible for the curative properties. Moreover, some of these elements are vitally important for various metabolic processes in the human body. They are closely linked to human growth and general health [24].

In this study, a total of sixteen elements (K, Zn, Cu, Pb, Cd, Cr, Mg, Ca, Mn, Na, Ti, Fe, Ni, Rb, Se and Co) were determined and findings documented in Tables 2 and 3. The study revealed that all the metals were accumulated to greater or lesser extents by the sample. Calcium was the most abundant macro element present in the ground dried leaf which was 24178.29 mg/100 g followed by potassium 4620.75 mg/100 g. Calcium is the main constituent of the skeleton, teeth and is important for regulating many vital cellular activities such as nerve and muscle function, hormonal actions, blood clotting, heart function, growth and cellular mortality. According to the Department of Health, Dietary Reference values for food energy and Nutrients, [25], Reference Nutrient Intake (RNI) for calcium is 700.00 mg/day for both adult male and female. Hence, *E. coccinea* leaf supplies above that, however it is a very good source of calcium. The high concentration of potassium in *E. coccinea* leaf is needed for many essential processes including enzyme activation, photosynthesis, water use efficiency, starch formation and protein synthesis. Potassium participates actively in the maintenance of the cardiac rhythm [26] and in constipation. Sodium level of the order of 284.80 mg/100 g did not exceed the Reference Nutrient Intake (RNI) for Sodium (1600 mg/day) according to the Department of Health, Dietary Reference values for food energy and Nutrients United Kingdom [25]. Magnesium level in *E. coccinea* was 124.25 mg/100 g, representing 46% of its Reference Nutrient Intake (RNI) for adult female (270.00

mg/day) and 41% for adult male (300.00 mg/day). The level of manganese was 72.65 mg/100 g which is above Reference Nutrient Intake (RNI) for adult female (5.00 mg/day), *E. coccinea* and adult male (5.50 mg/day), *E. coccinea* leaf is a very good source of manganese. Deficiency of manganese in humans causes myocardial infarction and other cardiovascular diseases, as well as also disorder of bony cartilaginous growth disorder in infants and children and may lead to immunodeficiency disorder and rheumatic arthritis in adults [27]. Zinc level was of the order of 27.78 mg/100 g which represents above 300% of its Reference Nutrient Intake (RNI) for adult female (7.00 mg/day) and above 200% for adult male (9.50 mg/day). Magnesium and zinc have important roles in the metabolism of cholesterol as well as heart diseases. Zinc is the component of more than 270 enzymes [28] and its deficiency in the organism is accompanied by multisystem dysfunction. Besides, zinc is responsible for sperm manufacture, foetus development and proper function of immune response [29]. Rubidium was 19.70 mg/100 g and it is a non-essential element for humans [30]. Iron was 17.83 mg/100 g with its Reference Nutrient Intake (RNI) for adult female placed at 14.80 mg/day and adult male at 8.70 mg/day according to Department of Health, Dietary Reference values for food energy and Nutrients United Kingdom [25]. Iron is an essential element for human beings and animals and is an essential component of haemoglobin. It facilitates the oxidation of carbohydrates, protein and fat to control body weight, which is an important factor in diabetes and obesity. According to FAO/WHO, the concentration of iron in the leaf was found to be within the permissible limit [31]. Nickel was 11.40 mg/100 g with its Reference Nutrient Intake (RNI) for both adult female and male being 1.00 mg/day. Nickel is required in minute quantities for body as it is mostly present in pancreas and hence plays an important role in

the production of insulin. Its deficiency results in the disorder of liver [32] and the daily intake should not exceed 1.0 mg since beyond this level it is toxic [33]. Selenium was 4.40 mg/100 g with its Reference Nutrient Intake (RNI) for adult female (75.00 mg/day) and male (60.00 mg/day). Titanium was 3.20 mg/100 g and copper was 2.66 mg/100 g having its Nutrient Intake (RNI) for both adult female and male as 1.20 mg/day. Copper is an essential nutrient that plays an important role in the production of haemoglobin, myelin, collagen and melanin [34]. Cobalt was 0.50 mg/100 g, chromium was 0.14 mg/100 g and cadmium was 0.04 mg/100 g. The permissible limit in raw material for Cr is 0.2 mg/100 g, Cd is 0.03 mg/100 g and Pb is 1 mg/100 g according to World Health Organization, [35]. Lead was not detected in the leaf sample. Absence of Lead, Cadmium within 0.04 mg/100 g and chromium below permissible limit (0.2 mg/100 g) in the raw sample of the leaf is evidence of the plant's safety for consumption and use as a traditional medicine. However, the mineral content levels reported by Faleye et al. [36] were lower, and this could be attributed to differences in soil conditions (soil type and mineral content), plant's root absorption capacity as well as different environmental conditions. The high calcium, potassium, manganese, zinc and iron contents in the leaf makes it valuable as a raw material for herbal medicine.

The amount of concentrated crude extracts and fractions from different organic solvents are summarized in Table 4. The amount of methanol crude extract obtained was 17.50 g per 700 g of *E. coccinea* dried leaf. The amount of hexane fraction was 9.77 g, dichloromethane fraction (1.83 g) and ethylacetate fraction (3.30 g). The result of the percentage yield of methanol crude

extract of *Emilia coccinea* leaf was 2.5% (Table 4).

The phytochemical screening showed the presence of tannins, saponins, steroids, alkaloids, flavonoids and phenols (Table 5). Tannin and saponin are anti-nutritional factors, although some permissible levels could be allowed in most formulations. In addition, they are good enough to be used as anti-diabetic agents. The steroids in the plant extracts were in moderate concentration. Steroids are useful in managing obesity, cardiovascular diseases because they are cardio-protective. The moderate level of flavonoids and phenols as antioxidants are indications that the extracts of *E. coccinea* will be ideal for development of nutraceutical formula recommended for management of old age and cardiovascular disease.

The result of the metals analysis determined using Atomic Absorption Spectrophotometer (Fe, Zn, Pb, Cd, and Cr) and X-ray Fluorescence spectroscopy (Ti, Ni, Rb, Se, and Co) is shown in Table 3. Pb was not detected (n. d.).

- Percentage Yield and amount of extractives from *E. coccinea* dried leaf
- Percentage Yield of Methanol crude extract of *E. coccinea* dried leaf

The result of the percentage yield of methanol crude extract of *Emilia coccinea* leaf was calculated using the following formula:

$$\% \text{Yield} = \{ \text{Weight of methanol crude extract (g)} \times 100 \} / \text{Weight of dried ground leaf used (g)}$$

Table 3. Metals constituents of dried *Emilia coccinea* leaf

Metals	Conc. in mg/kg	Calculated conc. in mg/100 g	Calculated conc. in g/100 g	Calculated conc. in g/kg
Fe	178.34±0.01	17.83	0.018	0.18
Zn	277.79±0.06	27.78	0.028	0.28
Ti	32.00±5.00	3.20	0.003	0.03
Ni	114.00±0.01	11.40	0.011	0.11
Rb	197.00±0.01	19.70	0.020	0.20
Se	44.00±6.00	4.40	0.004	0.044
Co	5.00±1.00	0.50	0.001	0.01
Pb	n. d.	n. d.	n. d.	n. d.
Cd	0.41±0.01	0.04	0.00004	0.00004
Cr	1.39±0.01	0.14	0.0001	0.0014

Values reported are mean conc. value± conc error of triplicate determinations

Table 4. Amount of the crude extracts and fractions from different solvents

S/n	Sample code	Weight of extracts/ fractions (g)
1	MCE	17.50
2	HF	9.77
3	DF	1.83
4	EF	3.30

Key: MCE-Methanol Crude extract
 HF-Hexane fraction from methanol crude extract
 DF-Dichloromethane fraction from methanol crude extract
 EF-Ethyl acetate fraction from methanol crude extract
 AqMF-Aqueous methanol fraction

Table 5. Qualitative phytochemical screening

	Tanin	Phlobatanin	Saponin	Steroid	Alkaloid	Flavonoid	Cardiac glycoside	Phenol	Reducing sugar
Leaf	+	-	+	+	+	+	-	+	+

Substituting for real values this translates to:

$$\%Yield = \frac{17.50 \text{ g}}{700.00 \text{ g}} \times 100$$

∴ %Yield = 2.5%

The weight of methanol crude extract and other fractions from methanol crude extract of *Emilia coccinea* leaf is shown in Table 4.

4. CONCLUSION

The current investigation has shown that the leaf of *E. coccinea* is of high food value, and contains appropriate concentration of micronutrients, and also deficient in heavy metals like lead which could act as poison to the human body. Research attention into development of this natural medicine (*E. coccinea*) into well refined functional food and beverages formulas will save foreign exchange reserves lost in the importation of alternatives from China. It will also provide employment, and add great value to the lesser – known medicinal plants. *Emilia coccinea* should be promoted for greater consumption to improve nutrition and strengthen immune functions. Hence, by cultivation and utilization of *Emilia coccinea* we can arrest hidden hunger consequences in Nigeria and across the globe.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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