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Research paper

Phytochemical analysis, mineral composition and *in vitro* antioxidant activities of *Celosia argentea* leaves

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Abstract

Background: *Celosia argentea*, a traditional vegetable in West and Central Africa is widely grown for ornamental purpose in the tropics and subtropics such as in Malaysia. The aim of this study is to determine phytochemicals, mineral composition and *in vitro* antioxidant activities of *Celosia argentea* leaves.
Methods: Qualitative phytochemical screening was carried out using standard procedures, Mineral analysis was carried out using Atomic Absorption Spectrophotometer (AAS) while antioxidant potential, free radical scavenging and reducing power scavenging activity were also carried out.
Results: The phytochemical composition revealed the presence of active ingredients such as glycosides, steroids, Saponins, Phenols, Flavonoids, and alkaloids while mineral analysis showed higher concentration in calcium (295mg/100g) and least concentration in chromium (0.85mg/100g). Other minerals and their concentrations includes magnesium (122.53mg/100g), potassium (128.33mg/100g), sodium (71.32mg/100g), iron (35.16mg/100g), zinc (5.42mg/100g), copper (2.18mg/100g), manganese (1.86mg/100g). Moreover, DPPH (2, 2-diphenyl-1-picrylhydrazyl) scavenging activity and reducing power activity of *Celosia argentea* increased as the concentration increases.
Conclusion: The present study reveals therapeutic potential of *Celosia argentea* leaves due to its bioactive compounds and minerals. Also, *Celosia argentea* possess powerful antioxidant activity and can therefore offer good protection against oxidative damage.

Keywords: *Celosia argentea; DPPH; Minerals; Phytochemicals; Reducing Power.*

1. Introduction

Celosia argentea is an annual herbaceous vegetable of the family Amaranthaceae known as sokoyokoto among the Yorubas in-south-western Nigeria. The leaves and stems are cooked into soups, sauces or stew with other ingredients [1]. In lndia, the leaves mixed with honey are applied to inflated areas and the seeds are used for the treatment of diabetes mellitus [2]. In south-east Asia, the flowers are used as medicine for dysentery, haemoptysis and menstruation problems [1].In Ethiopia and Democratic Republic of Congo the seeds are used as medicine for the treatment of diarrhea, dysentery and muscle troubles [3-4]. In Kenya, the Masai use its liquid extract as a bodywash for convalescents [5]. Externally, *Celosia argentea* functions as a disinfectant as well as treat inflammation [6], dysuria, poultices for broken bones [7], ailment for eyes and liver [8], mouth sore, blood diseases, and others [9]. The aim of this work is to determine the phytochemicals, mineral composition and in vitro antioxidant activities of *Celosia argentea* leaves.

2. Materials and methods

2.1. Collection, identification and preparation of plant materials

Fresh leaves of *Celosia argentea* were collected from a local farm in south eastern part of Nigeria. Identification and authentication were carried out after which the leaves were washed and air dried at room temperature for three (3) weeks. The dried leaves were grounded into fine powder using an electric blender and stored in a cool dry container until use for analysis.

2.2. Phytochemical analysis

Qualitative phytochemical screening to determine the presence of alkaloids, tannins, saponins phenols, anthraquinones, flavonoid and glycosides using standard methods as described by [10-14] were carried out.

2.3. Mineral analysis

Mineral analysis was carried out using Atomic Absorption Spectrophotometer (AAS) as previously done by Usunobun and Okolie, [15-16].

2.4. Determination of reducing power ability

The reducing power activity of *Celosia argentea* leaves was carried out using the reducing power method. A mixture containing 2.5 ml of 0.2 M phosphate buffer (pH 6.6) and 2.5 ml of $K_3Fe(CN)_6$ (1% w/v) was added to 1.0 ml of stock *Celosia argentea* leaves filtrate (0.2–1.0 mg/ml) prepared in distilled water.

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The resulting mixture was incubated for 20 min at 50°C, followed by the addition of 2.5 ml of TCA (10% w/v), followed by centrifugation at 3000 rpm for 10 min. 2.5 ml of the supernatant was mixed with 2.5 ml of distilled water and 0.5 ml of $FeCl_3$ (0.1% w/v). The absorbance was measured at 700 nm against reagent blank sample. Increased absorbance of the reaction mixture indicates higher reducing power of *Celosia argentea* leaves.

2.5. diphenyl-1-picrylhydrazyl (DPPH) radical scavenging ability

The DPPH method was used for the determination of DPPH free radical scavenging activity of *Celosia argentea* leaves as follows: DPPH (1 ml, 0.135 mM) prepared in methanol was mixed with 1.0 ml of stock *Celosia argentea* leaves filtrate ranging in concentration from 0.2 to 1.0 mg/ml. The reaction mixture was then vortexed thoroughly and left in the dark at room temperature for 30 min. The absorbance was measured at 517 nm. The scavenging ability was calculated using the equation:

DPPH scavenging activity (%) = $[(Abs_{control} - Abs_{sample})]/(Abs_{control})] \times 100$,

Where: $Abs_{control}$ is the absorbance of DPPH + methanol and Abs_{sample} is the absorbance of DPPH radical + sample (sample or standard).

2.6. Statistical analysis

Data obtained from this study were expressed as mean value ± standard deviation.

3. Results

Phytochemical screening reveals *Celosia argentea* leaves to contain flavonoids, saponins, alkaloids, phenols etc as shown in table 1

Table 1: Phytochemical Screening of *Celosia argentea* Leaves

Phytochemicals	*Celosia argentea*
Flavonoids	Positive
Saponins	Positive
Alkaloids	Positive
Tannins	Negative
Phenols	Positive
Glycosides	Positive
Anthraquinones	Negative

The result of the minerals as shown in table 2 shows *Celosia argentea* to be higher in calcium (295mg/100g) and least in chromium (0.85mg/100g). Other minerals includes magnesium (122.53mg/100g), potassium (128.33mg/100g), sodium (71.32mg/100g), iron (35.16mg/100g), zinc (5.42mg/100g), copper (2.18mg/100g), manganese (1.86mg/100g)

Table 2: Mineral Composition of *Celosia argentea* Leaves (mg/100g)

Mineral	*Celosia argentea* (mg/100g)
Calcium	295.00±3.65
Magnesium	122.50±4.01
Potassium	128.33±5.08
Sodium	71.32±2.76
Phosphate	135.79±5.58
Iron	35.16±3.05
Zinc	5.42±0.90
Copper	2.18±0.76
Manganese	1.86±0.21
Chromium	0.85±0.05

Values are means ± SD for 2 determinations

The scavenging activity of DPPH radical exerted by the leaf is summarized in Fig.1. The scavenging effect of *Celosia argentea* leaves in the range of 0.2-1.0 mg/ml increased in a concentration-dependent manner. Fig.2 showed that the reducing power of *Celosia argentea* leaves also had a dose-dependent effect i.e increased with increasing concentrations.

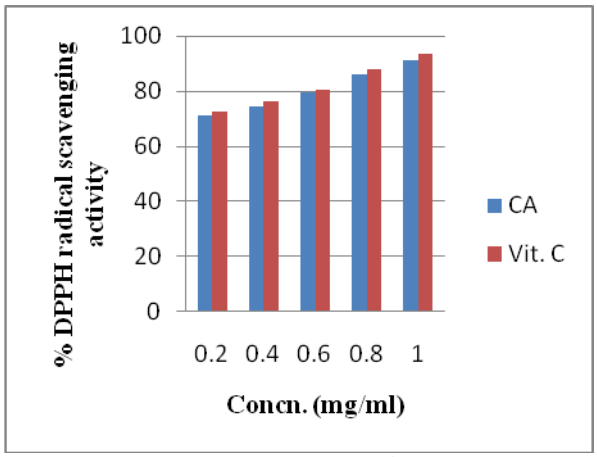


Fig. 2: DPPH Radical Scavenging Activity of *Celosaia argentea* (CA) Leaves.

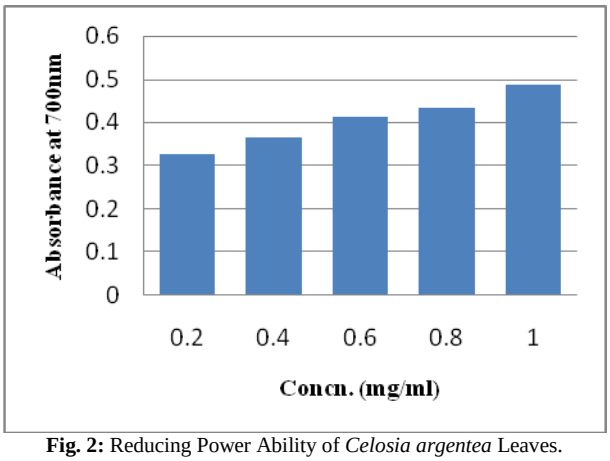


Fig. 2: Reducing Power Ability of *Celosia argentea* Leaves.

4. Discussion

This study showed that *Celosia argentea* leaves contained flavonoids, phenolics, saponins, glycosides, steroids and alkaloids. Flavonoids have been reported to exert wide range of biological activities. Including anti-inflammatory, antibacterial, antiviral, antiallergic, cytotoxic antitumour, treatment of neurodegenerative diseases and vasodilatory action [17]. Flavonoids are known to inhibit lipid-peroxidation, platelet aggregation, capillary permeability and fragility, cyclooxygenase and lipoxygenase enzyme activities. They exert these effects as antioxidants, free radical scavengers and chelators of divalent cation [18]. Flavonoids possess antidiarrhoeal [19] antibacterial [20] and antimicrobial [21] properties. This may be the scientific basis for the use of Celosia argentea for the treatment of skin diseases, pile, dysentery, inflammation, haematological and gynaecologic disorders

Saponins have been reported to have antihyper-cholesterol, anti-inflamatory, cardiac depressant properties [11] and appear to kill or inhibit cancer cells without killing the normal cells in the process [22]. Saponins have also been reported as antimicrobial and antifungal [23], thereby suggesting *Celosia argentea* potentials in treatment of fungi diseases like ring worm, guinea worm, skin diseases, craw-craw. In addition to antimicrobial and antifungal activities, saponins also aids digestion and enhances nutrient absorption [23].

Green leafy vegetables provide humans with adequate amounts of many vitamins and minerals and thus occupy an important place among the food crops. They are valuable in maintaining alkaline reserve of the body because of their nutrient and mineral contents

[24]. *Celosia argentea* in this study shows richness in calcium, potassium, sodium, magnesium, iron, zinc etc.

Sodium content of *Celosia argentea* (71.32mg/100mg) compared favourably with 69.49mg/100g of *Annona muricata* but high when compared to 48.31mg/100g of *Vernonia amygdalina* as reported by Usunobun and Okolie [15-16]. Potassium content of *Celosia argentea* (128.33mg/100g) is high when compared to 36.31mg/100g of *Annona muricata* and 62.79mg/100g of *Vernonia amygdalina* [15-16]. Calcium content of *Celosia argentea* (295mg/100g) is low when compared to 1118.30mg/100g of *Annona muricata* and 1264.18mg/100g of *Vernonia amygdalina* [15-16]. Calcium is known to play a significant role in muscle contraction, bone and teeth formation and blood clotting [25-26]. Sodium and potassium which are present in the intracellular and extracellular fluid helps to maintain electrolyte balance and membrane fluidity. It is known that inorganic mineral elements such as potassium, calcium play important roles in the maintenance of normal glucose-tolerance and in the release of insulin from beta cells of islets of Langerhans [27].

Magnesium content of *Celosia argentea* (122.53mg/100g) is low when compared to 961.9mg/100g of *Annona muricata* and 681.36mg/100g of *Vernonia amygdalina* [15-16]. Magnesium is a composition of chlorophyll and it is an important content in connection with Ischemic heart disease and calcium metabolism in bones [28](Ishida et al., 2000). Some of these minerals such as magnesium are needed as cofactor in enzyme catalysis in the body [25].

Zinc content of *Celosia argentea* (5.42mg/100g) is high when compared to 0.83mg/100g of *Annona muricata* and 1.42mg/100g of *Vernonia amygdalina* [15-16]. Zinc is involved in normal functioning of immune system [29] and is associated with protein metabolism. The leaves are a good source of zinc because it is far above 6.23 recommended by RDA [30].

Iron content of *Celosia argentea* (35.16mg/100mg) compared favourably with 32.20mg/100g of *Vernonia amygdalina* but high when compared to 13.95mg/100g of *Annona muricata* as reported by Usunobun and Okolie [15-16]. This perhaps justifies the already locally established function of the plant in the regulation of haemoglobin level. Iron is an essential trace element for hemoglobin formation, normal functioning of central nervous system and in the oxidation of carbohydrates, protein and fats [31]. Iron is known to be a component of some metalloenzymes, myoglobin and heamoglobin [25], which is needed in the transport of oxygen and carbon dioxide during respiration or cellular metabolism. This heamoglobin (containing iron) also serve as buffer to regulate changes in blood pH [32].

With regard to reducing power activity and DPPH radical scavenging activity, *Celosia argentea* leaves showed a concentration dependent activity and comparing its DPPH-radical scavenging activity and that of the standard (Vitamin C), it can be stated that *Celosia argentea* leaves would offer protection against oxidative damage to body cells. The concentration-dependent increase in reducing power ability and DPPH radical scavenging reflects the very high antioxidant activity of *Celosia argentea* and may justify its use as an antidote by some locals.

In conclusion, *Celosia argentea* leaves should continue to be used as food since it contains valuable phytochemicals and minerals. The traditional medicinal use should also continue since it contains many valuable phytochemicals (alkaloids, flavonoids etc) which are the basis for plant medicinal starting materials, in the synthesis of new drugs.

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