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Original Research Article

Determination of Proximate, Phytochemicals and Minerals Composition of *Amaranthus* spp

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Abstract: Vegetables are major sources of vitamins, minerals and bioactive components such phytochemicals and antioxidant that help in reducing the risk of diseases. The aim of the study was to determine the proximate composition, phytochemical screening and mineral composition of *Amaranthus* spp. leaf extract. The proximate composition and phytochemical screening were determined using conventional laboratory methods while the mineral composition of the leaves was determines using atomic absorption spectrophotometer. The proximate analysis of the leaf extract showed that it contains carbohydrate (48.6%), protein (18.2%), fats (5.4%), crude fibre (10.6%), moisture content (8.3%) and ash content (13.3%). The preliminary phytochemical screening of *Amaranthus* spp. leaf extract revealed the presence of Alkaloid, terpenoid, flavonoids, steroid, phenol, saponins and tannin. Quantitative phytochemical analysis of the extract showed that the flavonoids is the most abundant constituent in making about 11.6%, followed by steroid, alkaloid and phenol constituting 4.3%, 3.6% and 3.1% respectively. The mineral analysis of the extract indicate the presence of calcium (68.5 mg/100g), potassium (67 mg/100g), magnesium (89.8 mg/100g), phosphorous (62.5 mg/100g), zinc (8.0 mg/100g), iron (15.8 mg/100g) and copper (6.2 mg/100g). From the findings of this study, it is concluded that *Amaranthus* spp. leaf has therapeutic potential and can be used dietary supplements.

Keywords: *Amaranthus* spp., Minerals, phytochemicals, proximate analysis.

INTRODUCTION

Several compounds such as vitamins, minerals and bioactive components like phytochemicals and antioxidants which help in reducing the risk of chronic illness are the major constituents of vegetables [1]. Leafy vegetables contribute nutritionally by providing protein, vitamins, minerals and fibre, hence; form an important part of diet especially in the rural area [2]. The understanding of bioactive components (such as phytochemical and anti-oxidant composition) of vegetables, encourage their utilization for pharmaceutical and nutraceutical values [3]. Vegetable is very essential especially in developing countries where vitamins and mineral supply is inadequate to meet the nutritional requirement of the rapidly growing population. In Africa, indigenous leafy vegetables are used as relish and are eaten together with starchy staple foods [4]. Indigenous leafy vegetables play important role in being protective foods; used in human health maintenance and disease prevention [5,6].

Plants produce organic compounds that are not directly used in primary growth and development metabolic processes of plants [7]. These compounds are non-nutritive plant secondary metabolites that are also called phytochemicals [8]. These phytochemicals are antioxidant bioactive chemicals that prevent oxidative processes occurrences in animals and plants [9]. These essential phytochemicals include saponins, alkaloids, flavonoids, tannins and phenolic compounds [9], fibres, vitamins and water [10-12]. They are absorbed by the human body to be utilized as energy sources, body building and protective materials [11, 12]. They have high fiber content compared to root vegetables and cereals [10]. The high fiber content has been reported to reduce cholesterol levels in the body resulting in low occurrences of cardiovascular diseases [13]. Potassium from leafy vegetables is responsible for preventing body

diuretic and hypertensive complications [14] while oils/fats from vegetables lower blood lipids thereby controlling incidences of coronary diseases [10].

Amaranthus spp. belongs to the Amaranthaceae family and there are 60 recognizable species [15]. Findings from studies conducted on indigenous vegetables revealed that *Amaranthus* spp. vegetables have high antioxidant properties, [9]. This is despite having low proximate composition on fresh basis [16]. In addition, other researchers have reported that *Amaranthus* spp. contains crude protein and fat contents of 3.2 and 0.3%, respectively [5]. The leaves are boiled and in some cases groundnut flour is added and is usually consumed as relish. In Nigeria, *Amaranthus* leaves combined with condiments are used to prepare soup [17]. In Congo, their leaves are eaten as spinach or green vegetables [18]. These leaves boiled and mixed with a groundnut sauce are eaten as salad in Mozambique and in West Africa [19]. *Amaranthus* has been shown to contain many compounds that had both health and industrial benefits [20]. Despite the use of this plant for such purposes, there is little information on the nutritional and chemical composition of *Amaranthus* leaves. This work is therefore aimed to determine the nutrient and chemical compositions of *Amaranthus* leaves.

MATERIALS AND METHODS

Collection and Identification of *Amaranthus* leaves

The *Amaranthus* spp. leaves were purchased from Sabon-Gari Market located in Kano Metropolis Kano, Nigeria. The leaves were identified at Herbarium (Department of Plant Science, Bayero University Kano). A voucher number of BUKHAN 0236 was assigned to the specimens. Leaves were washed, air dried and pulverized into fine powder, then stored in air tight container for further use.

Fig-1: *Amaranthus* spp

Determination of Proximate Composition

The proximate composition of *Amaranthus* spp. leaf was determined using standard laboratory method to determine carbohydrate, fat, ash content, dry matter, crude protein and crude fibre [21]. The proximate parameters expressed in percentage (%) were obtained by taking the average value as the experiment was conducted in triplicate.

Phytochemical Screening

The preliminary phytochemical screening of *Amaranthus* spp. leaf extract was conducted using conventional methods described by Sofowora [22] and Trease and Evans [23]. The method was employed to determine the presence phyto-constituents such as flavonoids, alkaloid, phenol, terpenoid, steroid, tannins and saponins.

Qualitative Phytochemical Analysis

Various methods were employed in determining the amount of bioactive components (phytochemicals) present in *Amaranthus* spp. Terpenoid, steroid and tannin were determined using Spectrophotometric method while phenol was determined using Folin-Ciocalteu procedure. The alkaloid, flavonoids and the content of saponin were evaluated using standard method described by Adeniyi *et al*. [24].

Determination of Mineral Composition

Atomic absorption spectrophotometer was used to determine the mineral composition of the leaves such as calcium (K), zinc (Zn), potassium (K), iron (Fe) phosphorous (P) and magnesium (Mg). The result obtained was expressed mg/100g [21].

RESULTS

Proximate Composition

The result of proximate composition (both qualitative and quantitative) of *Amaranthus* spp. leaf is presented in Table 1 below. The qualitative result showed the presence fats, carbohydrate, protein, fibre, ash and moisture. Quantitatively, carbohydrate has the highest composition which accounted for 48.6%, this is followed by protein (18.2%), ash content (13.3%), crude fibre (10.6%), and moisture content 8.3% while fats has the least composition which accounted for 5.4%.

Table-1: Proximate analysis of *Amaranthus* spp. leaf

S/N	Nutrients	Composition (%)
1.	Carbohydrate	48.60±1.50
2.	Protein	18.20±1.20
3.	Fats	5.40±0.23
4.	Crude fibre	10.60±0.30
5.	Moisture content	8.30±0.04
6.	Ash content	13.30±0.23

Phytochemical Screening of *Amaranthus* spp. leaf

Table 2 represents the result of preliminary phytochemical screening of *Amaranthus* spp. leaf. Both qualitative and quantitative results were presented. The following phytochemicals were obtained; flavonoid, alkaloid, saponin, tannin, terpenoid, phenol and steroid. On the other hand, flavonoid has the highest content (11.6%), followed by steroid (4.3%), alkaloid (3.6%) and phenol (3.1%).

Table-2: Qualitative and quantitative phytochemical screening of *Amaranthus* leaf extract

S/N	Phytochemicals	Qualitative screening	Quantitative screening (%)
	Alkaloid	+	3.60±0.23
	Flavonoid	+	11.60±1.30
	Saponin	+	1.30±0.50
	Steroids	+	4.30±0.25
	Terpenoid	+	1.80±0.04
	Phenol	+	3.10±0.20
	Tannin	+	2.40±0.03

Key: + = Present, - = absent of phytochemical

Mineral Analysis of *Amaranthus* spp. leaf

Table 3 represent the mineral analysis of *Amaranthus* spp. leaf. The result in mg/100mg indicated that magnesium has the highest composition (89.8mg/100g), followed by calcium (68.5mg/100g), potassium (67mg/100g) and phosphorous (62.5mg/100g). others include; iron (15.8mg/100g), zinc (8mg/100g) and copper (6.2mg/100g).

Table-3: Mineral analysis of *Amaranthus* spp. leaf

S/N	Minerals	Composition (mg/100g)
1.	Potassium	67.00
2.	Calcium	68.50
3.	Magnesium	89.80
4.	Phosphorous	62.50
5.	Zinc	8.00
6.	Iron	15.80
7.	Copper	6.20

DISCUSSION

The preliminary phytochemical screening of *Amaranthus* spp. leaves extract revealed the presence of saponin, flavonoid, tannin, terpenoid, alkaloid, phenol and steroid. These bioactive components are beneficial to human health due exhibit different biochemical and pharmacological actions as well as possessing antioxidant activity [25]. Several studies were conducted determine and characterized various bioactive components of *Amaranthus* spp. Leaf [26,27]. This resulted in screening of various bioactive components such as alkaloid, flavonoid, tannin, saponin and phenolics [26]. Findings from the present study correlate with that of Akubugwo *et al*. [26].

Alkaloids play important metabolic roles and development in the system of living organisms [28]. It is beneficial chemical to plants serving as repellent to parasites and predators. The alkaloid is known to contain antimicrobial agents which accounted for its antimicrobial activity [3]. Flavonoid is believed to contain antioxidant agents and it is reported that it reduce the oxidation of low-density lipoprotein, lower cholesterol level and triglyceride [29]. It is also expressed in plant in respond to microbial attack suggesting their antimicrobial property [30]. Saponins limit the growth and viability of cancer cell by reacting with cholesterol rich membrane of cancer cell [31]. Pharmacologically, saponin is responsible for most cellular activities related to cell division and growth in human and has incivility effect on inflammation. Hence, the use of *Amaranthus* spp. leaves justifies the use of plant in the management of inflammation [32]. Steroid is important in pharmaceutically for production of drugs due to possession of compound showing similarities to sex hormones [33]. Terpenoid is known to possessed anticancer, anti-parasitic, antimicrobial, antifungal, immunomodulatory, anti-inflammatory, antiviral, anti-allergic and antispasmodic properties [34]. Phenolics are reported to possessed antioxidant property which prevents oxidative damage of cell due to present of free radical scavengers [35]. The phenolics lower the risk of heart diseases and provide anti-inflammatory activity due to their ability to neutralize or scavenge free radicals [36]. Tannins are known to have potential antiviral activity [37] as well as anticancer agent [38].

The proximate composition of *Amaranthus* spp. leaf according to the present study contains a high amount of protein and carbohydrate. However, there are moderate amount of fibre, ash, moisture and little amount of fat. This result supported the findings of Akubugwo *et al*. [26] and Chatepa and Masamba, [27] who reported that *Amaranthus* spp. contain carbohydrate, protein, fibre, fats, amino acid, minerals and vitamins. High content of carbohydrate (48.7%) in *Amaranthus* spp. leaf from this study indicated that it is a good source of energy [3]. Presence of protein in *Amaranthus* spp. is very vital. The proteins are building block units needed for manufacturing hormones, enzymes, brain chemicals and necessary elements for manufacturing DNA. Antibodies produced by protein are used for defense against germs [39]. From the result of the present study, *Amaranthus* spp. leaf contained crude fibre of about 11.6% which justified the report that *Amaranthus* spp. contained 11.7% of crude fibre Chatepa and Masamba, [27]. The fibre inhibits the intake of starchy food and hence, prevents body metabolic condition such as diabetes and cholesterol [40]. According to the present study, *Amaranthus* spp. contains low fat (5.4%). This agrees with the report of Akubugwo *et al*. [26] who reported crude fat values ranges from 4.65%. A food providing 1 – 2% of fat is sufficient for healthy human as excess fat consumption has implication and may lead to certain cardio-vascular disorder [41].

Analysis of mineral composition of *Amaranthus* spp. leaf in the present study confirmed the presence of both trace (zinc, iron and copper) and major (potassium, phosphorous, calcium and magnesium). This justifies the vitality of the plant leaf nutritionally especially when consumed by animals or humans. Minerals play important metabolic role in the body of animals, such activities include maintenance of acid balance in the body, production and activity of enzymes and so on [3]. Presence of potassium in the extracellular body fluid is vital, it conduct several functions to the body system such as regulation of osmotic pressure, conduction of nerve impulse and maitainance of acid-base balance [3]. Calcium played major role in formation and development of bones and teeth, coagulation of blood, contraction of muscle, normal functioning of heart and nervous system [42]. Presence of magnesium in a diet is vital for decreasing blood sugar as result of improving the functions of insulin [43], metabolism of fats and carbohydrates [3]. Presence of zinc in *Amaranthus* spp. leaf made it important for nerve functioning and normal sexual development. Zinc is also vital for stimulating the activity of vitamins as well as formation of red and white blood cells [43]. Zinc is an integral part of many enzymes in the body and also played important role in proper functioning of body immunity [43]. Copper as a trace element is essential for cellular defense, mucous membrane protection, anti-anemic and vital for haemoglobin formation [44].

CONCLUSION

Based on the findings of the present study, the *Amaranthus* spp. leaf extract contain an adequate amount of food substances, phytochemicals and mineral elements and thus provide a basic rationale for the use of the plant as herbal medicine and food substances. However, it can deducted that *Amaranthus* spp. leaves can be used significantly as a nutrient requirement for normal growth and development as well as protection against diseases and microbial invasion due to the presence of phytochemicals.

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