

# Determination of the Flavonoid Composition of Seven Varieties of *Vigna unguiculata* (L.) Walp as Food and Therapeutic Values

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**Abstract** The leaves, stems, roots and seeds of seven varieties of *Vigna unguiculata* (L.) Walp var. 'Oloka', var. Ifebrown, var. 'Kafanji', var. 'Sokoto guzo', var. Crowder pea, var. Potiskum and var. Iron beans consumed in Awka Anambra State were examined for flavonoid compositions using gravimetric method. The similar samples of each of the leaves, stems, roots and seeds were subjected to phytochemical analyses of qualitative and quantitative determination. The qualitative analyses revealed that the leaves, stems, roots and seeds of the plant under study contain flavonoid. For quantitative analyses, all the parts of the *Vigna unguiculata* varieties examined contain flavonoids but in various percentages. Oloka variety contains the highest flavonoids in the parts examined. On comparison with other varieties, it was discovered that var. Oloka contains the highest flavonoid in the stem, roots and seed having the following mean value (1.48, 1.42 and 0.81) respectively while Sokoto guzo contains the highest flavonoid in the leaves with the mean value of 1.67. This finding indicates that *Vigna unguiculata* is a good source of flavonoid and therefore can be useful in the diet as food and in ethnomedicine for the manufacture of drugs.

**Keywords** *Vigna unguiculata*, Flavonoid, Phytochemical

## 1. Introduction

*Vigna unguiculata* is an annual legume which belongs to the genus *Vigna* that consist of more than 200 species. It is one of the several species of the widely cultivated *Vigna* that belongs to the kingdom plantae, family fabaceae formerly papilionaceae and subfamily faboideae [1]. The planting area is more than 12.5million hectares worldwide, with an annual production of more than 3million tons [2]. Nigeria is the

largest producer and consumer, accounting for about 45 percent of its world's production [3,4] while the whole of Africa accounts for about 75% [5].

It is chiefly a vegetable and grain crop for human who values it as a nutritional supplement to cereals and an extender of animal proteins, and it serves as a very safe fodder for livestock animals.

Cowpea has vast utility in the food culture of both man and animal [6,7]. The crop ensures and provides uninterrupted protein supply throughout the year, either as fresh immature pods or as dry grains [8]. In many parts of West Africa including Nigeria, cowpea seeds are consumed as boiled seeds, seeds can also be converted into flour or paste and used for the preparation of indigenous food such as akara (bean cake) and moin moin (steamed cowpea seed) [9]. Its flour has been processed and used in many other food preparations such as baby foods and baked production [10].

In Cambodia, the pulse is considered antibilious and prescribed in liver complaints with jaundice. Seeds of *Vigna unguiculata* are used to strengthen the stomach, seeds and pod refuse are also used medicinally in China and Malaya [11].

Phytochemicals are compounds that occur naturally in plants. They contribute to the colour, flavour and smell of the plants. Phytochemical also forms part of plants natural defense mechanism against pathogenic substances. Okwu [12] reported their therapeutic importance to human health and disease prevention. Leguminous plants synthesize in their cells a great variety of phytochemical particularly isoflavones, flavonoid, phenolic compounds, lignins, alkaloids and cyanogenic glycosides [12,13].

Flavonoids are widely distributed in plants. The widespread distribution of flavonoid and their low toxicity compared to other plant metabolites (such as alkaloids) have resulted in many animals and humans having significant quantities in their diet. Naturally occurring flavonoids are potentially anti-allergic, anti-carcinogenic,

anti-inflammatory and anti-cancer activities [13]. Consumers and manufacturers have become interested in flavonoids for their medicinal properties particularly their roles as potentially important in dietary against cancer chemo protective and cardiovascular disease prevention [14]. Although *Vigna unguiculata* has long been regarded as food especially the seed and sometimes the leaves for animal fodder, it is found to be under-utilized. Flavonoids from *Vigna unguiculata* are naturally occurring and therefore can be isolated and put to use.

The use of plants as medicine has contributed greatly to the modern development of paramedical drugs. Scientist all over the world have been interested in knowing the chemical constituents present in most of these plants which have led to many research works on plants. Prior to this, it becomes necessary to investigate the composition of flavonoid in different parts of seven varieties of *Vigna unguiculata* consumed in Awka Anambra State Nigeria namely var. Oloka, var. Ifebrown, var. Kafanji, var. Sokoto guzo, var. Crowderpea, var. Potiskum and var. Iron beans in respect to their utilization as food and therapeutic values.

## 2. Materials and Methods

The leaves, stems, roots and seeds of seven varieties of var. 'Oloka', var. Ifebrown, var. 'Kafanji,' var. 'Sokoto guzo', var. Crowderpea, var. Potiskum and var. Iron beans were collected in the month of November–December from the Botanical garden at Nnamdi Azikiwe university Awka Anambra State, Nigeria. This was authenticated by a plant Taxonomist Prof. C.U. Okeke of the Department of Botany Nnamdi Azikiwe University, Awka, where the specimen voucher was deposited.

### Preparation of Plant Materials

The stems, roots and seed were sun dried for 14 days. The leaves were dried at room temperature in the laboratory under observation to ensure there are no effects of fungi. On fully dried, the dried samples were first crush with mortar and pestle, then to have a fine powder of the samples, manual grinder (Corona, USA) was used.

### Qualitative Determination

Similar sample of each of the plant extracts, leaves, stems, roots and seeds of the seven varieties of *Vigna unguiculata* was subjected to qualitative determination for the presence of flavonoid in the samples. This was carried out thus;

#### Test for Flavonoid

To a test tube, add 2ml of aqueous extract and a few drops of Bench concentrated ammonia (NH<sub>4</sub>). Formation of a yellow colouration shows the presence of flavonoid.

+ was used to indicate the presence of flavonoid.

### Quantitative Determination of Flavonoid

The flavonoid content of the sample of the plant was determined by the gravimetric method as was described by [15]. 5g of the powdered sample was placed into a conical flask and 50ml of water and 2ml HCL solution was added. The solution was allowed to boil for 30minutes. The boiled mixture was allowed to cool before it was filtered through what man filter paper (No 42). 10ml of ethyl acetate extract which contained flavonoid was recovered, while the aqueous layer was discarded. A pre weighed what man filter paper was used to filter the second (ethyl-acetate layer); the residue was then placed in an oven to dry at 60°C. It was cooled in a dissector and weighed. The quantity of flavonoid was determined using the formula;

$$\% \text{ Flavonoid} = \frac{W_2 - W_1}{\text{Weight of sample}} \times \frac{100}{1}$$

Where:-

W<sub>1</sub> = weight of empty filter paper

W<sub>2</sub> = weight of paper + Flavonoid extract

## 3. Statistical Analyses

Quantitative data obtained were statistically analysed by calculating the mean of the three replicates then calculation of sum of squares, variance, standard deviation, standard error. The results were presented as mean ± standard error.

## 4. Results and Discussion

The results of the qualitative analysis showed that flavonoid was present in all the parts of *Vigna unguiculata* varieties examined. The highest composition of flavonoid in the leaves was found in var. 'Sokoto guzo' (1.67±0.000%) similarly in the stem, root and seed, and the highest flavonoid was found in var. 'Oloka' (1.48±0.000%, 1.42±0.000% and 0.81±0.014%) respectively (Table 1 and 2).The various composition of flavonoid in the parts of the plants revealed the wide distribution of flavonoid in the plant and also revealed that plant extract are known to contain phytochemical compounds which have medicinal effects accumulated by plant organic substances [16].The high consumption of seed and leaves of *Vigna unguiculata* by human and animals is because of the low toxicity of flavonoid in them compared to other plants metabolites [16].

The leaves of 'Sokoto guzo' have the highest composition of flavonoid (1.67±0.000%).This agrees with the report of [17] that flavonoid are present in high concentration in the epidermis of the leaves and accounts for its importance and varied roles as secondary metabolites.

**Table 1.** Qualitative analysis of flavonoid in the leaves, stems, roots and seeds of seven varieties of *Vigna unguiculata*

<i>Vigna unguiculata</i> varieties	Leaves	Stem	Root	Seed
Oloka	+	+	+	+
Kafanji	+	+	+	+
Ifebrown	+	+	+	+
Potiskum	+	+	+	+
Iron beans	+	+	+	+
Sokoto guzo	+	+	+	+
Crowder pea	+	+	+	+

**Table 2.** Quantitative Flavonoid content of leaves, stems, roots and seeds of seven varieties of *Vigna unguiculata* (%)

<i>Vigna unguiculata</i> varieties	Leaves	Stem	Root	Seed
Oloka	1.31±0.021	1.48±0.000	1.42±0.000	0.81±0.014
Kafanji	1.08±0.021	1.07±0.021	0.94±0.021	0.74±0.007
Ifebrown	0.92±0.000	1.25±0.000	1.09±0.007	0.73±0.000
Potiskum	1.31±0.021	1.19±0.014	1.05±0.000	0.64±0.014
Iron beans	1.13±0.000	0.93±0.014	0.90±0.007	0.76±0.028
Sokoto guzo	1.67±0.000	1.35±0.000	1.06±0.000	0.67±0.021
Crowder pea	1.05±0.000	1.14±0.000	1.18±0.014	0.67±0.021

Var. Oloka contains the highest flavonoids in the stem, root and seed (Table 1 and 2); this suggests that the variety has high therapeutic values. [17] reported that flavonoids are present in high composition in the skin of fruits and this has been reported in addition by several workers that the flavonoids subclass of phenolics are primarily recognized as pigments responsible for the many shades of yellow, orange and red in flowers and food [18,19,20]. This is as well-being the reason for the various colours in flower and seeds of *Vigna unguiculata*. The use of plants as medicine therefore has contributed greatly to the modern development of paramedical drugs. Scientist all over the world have been interested in knowing the chemical constituents present in most of these plants which have led to many research works on plants.

These phytochemicals are compounds that occur naturally in plants. They contribute to the colour, flavor and smell of the plants. Phytochemical also forms part of plants natural defense mechanism against pathogenic substances. [12] reported their therapeutic importance to human health and disease prevention. Flavonoid which is one of these metabolites was discovered to produce anthelmintic activities [21]. This report indicated that these varieties have therapeutic values. Therapeutic actions of flavonoids have also been reported by [22, 13]; stating that flavonoid are of clinical value in low oestrogen states like menopause or imbalance and toxic oestrogen sensitive conditions such as breast, uterine and prostate tumor growth. This statement revealed that the leaves, seed, root and stem of this plant can equally be included in the diet especially for older people.

Var. 'Oloka' has the highest composition of flavonoid in the stem, root and seed indicating that the high consumption and utilization of this other parts (root and stem) is a huge advantage.

In addition *Vigna unguiculata* is useful in anorexia, constipation, helminthiasis and general debility activity of the seeds [23]. This is why consumers and manufacturers have become interested in flavonoids from this plant for their medicinal properties particularly their roles as potentially important diet against cancer chemoprotective and cardiovascular disease prevention [15]. The leaves are chewed to release toothache and powdered carbonized seeds are applied to insect stings, this indicates that var. 'Sokoto guzo' and var. 'Oloka' can serve as a good medicine in the cure of skin infection. This supported the findings of [24] that modern authorized physicians are increasing their use of pure flavonoids to treat many important common diseases, due to their proven ability to inhibit specific enzymes and scavenge free radicals. [25] Also, this stated the high composition of flavonoid in the Citrus species and its medicinal values [26], and revealed the flavonoid composition of *Capsicum annum* in the study on the phytochemical constituents of Var. Nsukka yellow pepper. This supports the work [27] that medicinal properties of plants could be based on the antioxidant, antimicrobial and antipyretic effects of the phytochemical in them. These constituents are chemical compounds formed during plants normal metabolic processes often referred to as 'secondary metabolites' of which there are other classes including alkaloids, flavonoids, tannins and others [16,12].

## 5. Conclusions

The high flavonoid composition in the parts of *Vigna unguiculata* especially in the stem of var. 'Oloka' and leaves of 'Sokoto guzo' revealed their medicinal properties. The seven varieties may be considered as a good source of flavonoid since they are affordable and available for their health benefit. Leaves, stems and roots which are mainly used as fodder for animal, especially in this part of the country can now be included in human diet because of its high flavonoid composition which proves their therapeutic values.

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