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Full Length Research Paper

DETERMINATION OF THE FREE RADICAL SCAVENGING PROPERTIES AS INDICES FOR EVALUATING THE ANTICANCER EFFECTS OF *VIGNA SESQUIPEDALIS*

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ABSTRACT
Vigna sesquipedalis was assayed to determine its content of essential minerals and vitamins that are commonly associated with the ability to neutralize the damaging effects of free radicals and consequently help prevent the development of cancer. Selenium, zinc, manganese, copper and iron which have antioxidant capability were determined among other minerals. The antioxidant vitamins, A, C, and E were also assayed among other vitamins. Appropriate colorimetric and titration methods were used for assay of vitamins while the minerals were determined by means of atomic absorption spectrophotometer. The results of the analyses showed that the seeds have significant concentrations of vitamins A and C while vitamin E concentration was relatively low. Also the minerals zinc, iron and manganese were significantly present while selenium and copper were of relatively low concentrations. However, the antinutrients namely trypsin inhibitor, haemagglutinin, and glycosides were found to be present. The results show that *Vigna sesquipedalis* has significant concentration of substances that are effectively involved in free radical scavenging and which can consequently enhance the body's protection against cancer development. The consumption of natural foods should be highly encouraged to reduce the chances of development of cancer associated with increased consumption of industrially processed foods.
Keywords:*Vigna sesquipedalis*, free radicals, antioxidants, vitamins, minerals.

INTRODUCTION
Vigna sesquipedalis is an annual crop commonly widely cultivated in various areas in the South East of Nigeria and consumed as a vegetable delicacy. It is often harvested freshly green, cooked and eaten in combination with a blend of other vegetables and other food crops that make the diet richer and more delicious. The pods can as well be harvested at maturity, dried and the seeds cooked or stored for future use. Other workers have also reported the

nutritional relevance of Asparagus beans and its importance as a major staple food (Nzewi *et al.*, 2011; Nwosu *et al.*, 2010). Several reports also suggest that the crop indeed has a global spread (Abel, 1985).

The continued increase in consumption of processed food at the expense of natural ones has continued to pose a major threat to life. The metabolism of processed food often leads to generation of high levels of oxidants and free radicals that if not properly checked will precipitate certain disease conditions including cancer. Natural foods (and herbs) contain numerous essential nutrients and substances that are useful in maintenance of health by scavenging the free radicals and exhibiting antioxidant activities.

Cancer constitutes one of the major causes of death globally and the causes are very diverse. One of the principal causes of cancer is attributed to oxidative metabolism that generates a range of free radicals (atoms or group of atoms whose reactivity can result to cell damage) such as hydrogen peroxide, hydroxyl radicals, superoxide radicals, nitric oxide, lipid peroxides, etc., that circulate in the body. The circulating free radicals, when their concentration rises above the body's antioxidant protection capacity, can be available to undergo reactions with other substances; such reactions can lead to development of various conditions including cancers, heart diseases, arthritis, atherosclerosis, cataracts, etc. Damage to cellular DNA can be a consequence of abnormality in cell division, caused by environmental agents, or it may be inherited. Cancers are indeed caused by a wide ranging agents including viruses, environmental chemicals and radiations and since cancers develop slowly and takes a long time to manifest, it may not be easy to establish the cause of any cancerous appearance. Moreover, since cancers have no definite cure it is absolutely more beneficial to apply preventive measures to minimize the tendency of their development.

Since cancer remains a global health challenge with escalating threat to life, the consumption of combatant nutrients through dietary intake and certified supplements remains an approach in effort to prevent the development of the disease. The development of cancer and various cardiovascular diseases has strong bearing on the nature of foods, extent/methods of processing, and eating habits. Locally, the cultivation of various valuable crops has diminished significantly; while many of such crops have gone into extinction, others are seriously under the threat of the same fate. The preference of consumption of processed, fast foods to natural foods with full complement of nutrients that have very high potential to equip the body to fight diseases need to be urgently halted or largely minimized. This will to a large extent reduce the chances of developing diseases that today pose great challenge to global science and health.

In this study, we undertook the study of identifying the presence of pharmacologically important bioactive nutrients in *Vigna sesquipedalis* in order to prove the benefits of this all-important food crop as a useful tool to protect the body from development of important diseases such as cancer and cardiovascular diseases.

MATERIALS AND METHODS

Collection and processing of Sample

Asparagus bean pods were purchased from a local market in Awka, Anambra State, Nigeria. The seeds were removed from the husks and gently rinsed with distilled water. They were air-dried under shade until constant weight was attained and the sample was pulverized for various analyses.

Antinutrients

The sample was analyzed for antinutrients including cardiac glycosides, haemagglutinin, trypsin inhibitor, oxalate and phytate. Cardiac glycoside and trypsin inhibitor were determined according to the methods of Harborne (1992). Oxalate was assayed by titration with potassium permanganate ($KMnO_4$) as described by Munro *et al.*, (1969), while phytate was analyzed according to the description of Young and Graves (1940). Haemagglutination assay was determined by the three step method involving extraction, red blood cell preparation and spectrophotometric assay (Meimeth *et al*., 1992).

Analysis of Vitamins

The analyses of vitamins were carried out as previously described by Enemor *et al.*, (2014). Carotenoids (pro-vitamin A) and tocopherol (vitamin E) were determined by colorimetric method (Kirk and Sawyer, 1991) with absorbance read from Jenway 60610 spectrophotometer at 325nm for vitamin A and 410nm for vitamin E. Ascorbic acid (vitamin C) analysis was assayed by titration method described by Kirk and Sawyer 1991. The B – complex vitamins, including thiamine (vitamin B_1), riboflavin (vitamin B_2), and cobalamine (vitamin B_{12}) were assayed by colorimetry with absorbance read at 261nm, 242nm, and 361nm, respectively. Niacin (vitamin B_3) and pyridoxine (vitamin B_6) were assayed by titration according to the guidelines of the British Pharmacopoiea (1993).

Minerals

Analyses were carried out to quantitatively identify the presence of certain minerals in the plant seeds. Determination of the concentrations of various elements was done by means of the Varian Atomic Absorption Spectrophotometer (FS 240). Some pharmacologically important metallic elements including lead, mercury, arsenic, cadmium, iron, etc, were determined. Wet digestion of sample with HNO_3/ $HClO_4$/ H_2SO_4 mixture was done according to the method of Adrian (1973).

RESULTS

Seeds of *Vigna sesquipedalis* were shown to contain high concentrations of vitamin A (caroteinoids) and vitamin C (ascorbic acid). Tocopherol (vitamin E) and the B-complex vitamins occur in the seeds at much lower concentrations (Figure 1).

The outcome of mineral analyses is represented in figure 2. The antioxidant elements, zinc, iron, and manganese were significant as shown. Other physiologically important elements such as sodium, calcium and sodium also showed significant concentrations.

The antinutrient contents of the seeds are shown in figure 3 with cardiac glycosides, haemagglutinin, and trypsin inhibitors occurring in higher quantities; oxalate and phytate were rather insignificant.

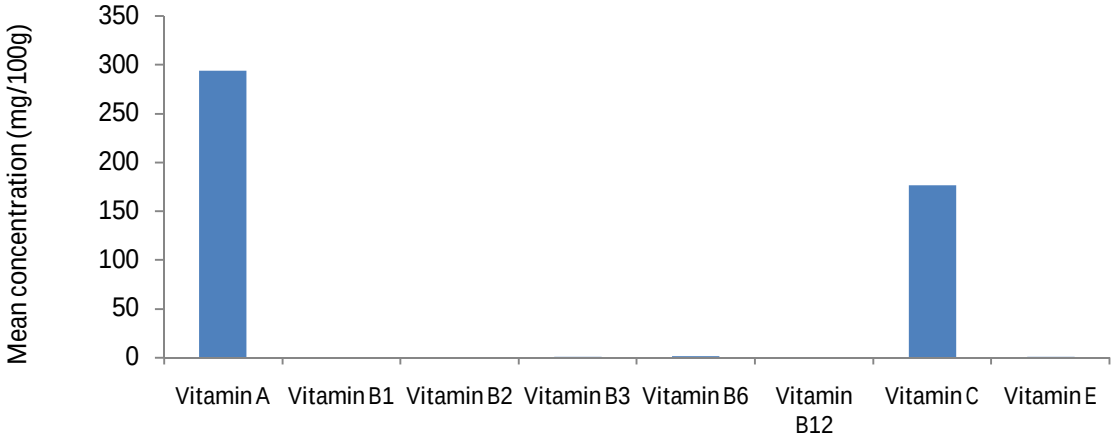

Figure 1: Concentration of vitamins in *Vigna sesquipedalis* (Data presented as mean ± SD of triplicate values).

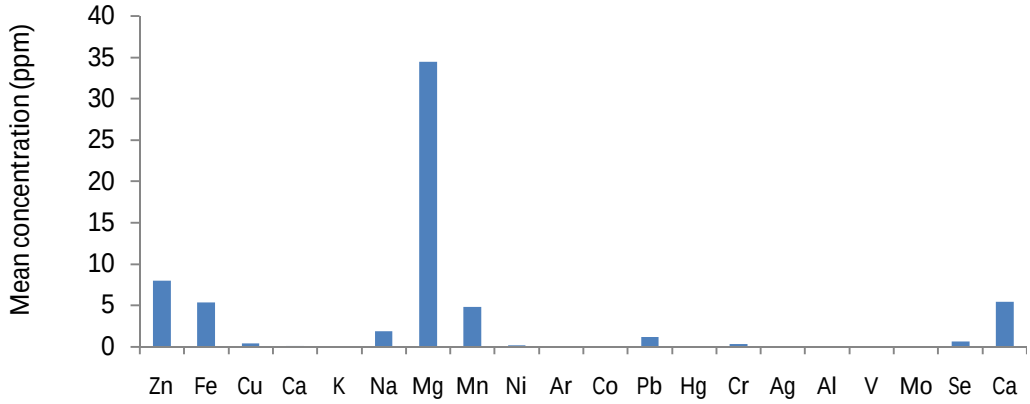

Figure 2: Mean concentration of minerals in *Vigna sesquipedalis*(Data presented as mean ± SD of triplicate values).

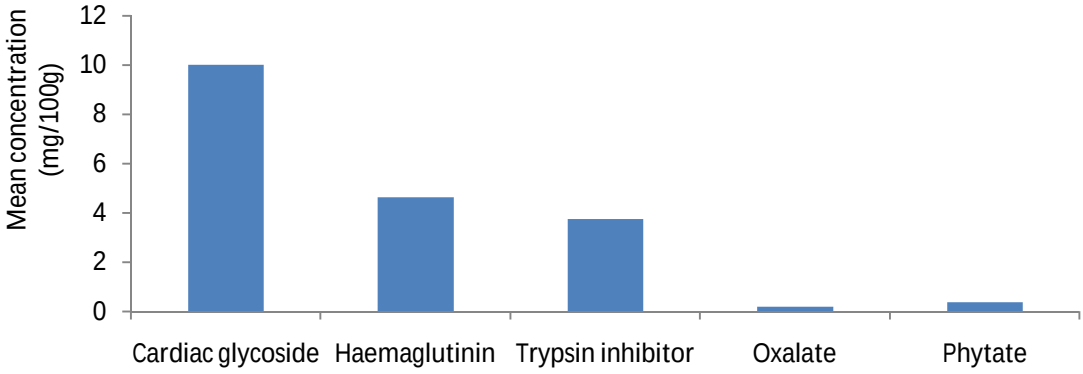

Figure 3: Concentration of some antinutrients in *Vigna sesquipedalis* (Data presented as mean ± SD of triplicate values).

DISCUSSION

Several foods and natural products are known to contain wide ranging nutrients and secondary metabolites that influence the health status of individuals very significantly. Constructive dieting is key to physiological and biochemical activities that culminate in balanced health. Scientific research has continued to reveal the rich bioactive nutrient composition of grains/cereals, vegetables and fruits (Enemor *et al*., 2014; Enemor *et al*., 2013; Ujowundu *et al*., 2008).

Our studies reveal that *Vigna sesquipedalis*is rich in various essential nutrients including those with antioxidant properties that enhance the scavenging of free radicals. The antioxidant vitamins, vitamin A and vitamin C were found to occur in high concentration in the seeds of *Vigna sesquipedalis.* Vitamin A is generally known to play important roles in maintaining healthy vision; it is also protects against cancer development, enhances immune function, and protect skin cells against ultraviolet radiations (Prakash and Gupta, 2009). The roles of vitamin A in promoting growth and development, maintenance of epithelial cellular integrity, immune function and reproduction has been well reported (WHO/FAO, 2004).

Vitamin C is a natural, water-soluble antioxidant which, in addition to its ability to scavenge reactive oxygen species, possesses anticarcinogenic properties (Prakash and Gupta, 2009). Zinc is an antioxidant which, functioning in synergy with other antioxidant systems, is very essential for free radical scavenging. Additionally, zinc plays essential roles in the maintenance of the immune systems, reproductive and digestive systems. Besides these, zinc plays many other crucial roles in the body. *Vigna sesquipedalis* has shown significant concentrations of zinc in the seeds thus highlighting the bioactive benefits of the crop in health maintenance. Iron and manganese are also significantly concentrated in the seeds of *Vigna sesquipedalis.* Both minerals are known for their roles as antioxidants. Manganese and zinc usually complex with the antioxidant enzyme, superoxide dismutase to form very strong antioxidant systems. In the presence of the mineral antioxidants, superoxide dismutase metabolizes superoxide radicals to hydrogen peroxide which, by the action of glutathione peroxidase and catalase, is converted to water. Iron is known to play numerous physiological roles. Magnesium, calcium and sodium were also significantly concentrated in the seeds. These minerals are well known as essential nutritional contents of foods due to important physiological roles associated with them.

We conclude that *Vigna sesquipedalis* is a nutritionally important crop. The protective properties of the plant seeds against cancer development, cardiovascular diseases, arthritis, etc, is very evident, considering its content of antioxidant minerals and vitamins in significant amounts. Besides these crucial bioactive features, the seeds have other nutrients that participate in diverse physiological roles. This and various other food crops have great potentials in protecting against development of various disease conditions that substantially defy treatment with currently available drugs. The current trend of high level consumption

of processed foods freely or blended with artificially manufactured spices is an obvious threat to good health and longevity and should be vigorously discouraged.

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