

DPPH Radical Scavenging Activity of Selected Fruits and Vegetables in Dekina Local Government Area of Kogi State, Nigeria

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Abstract: DPPH radical scavenging activity is commonly used to assess antioxidant potential of biological materials. In this study, five fruits (Apple, watermelon, Sweet Garden egg, Bitter Garden egg, and Cucumber) and four vegetables (Spinach, Bitter leaf, Tomato, Pumpkin leaf) were selected from the Eastern part of Kogi State, Nigeria. DPPH radical scavenging activity was performed on each sample at four different concentrations (25µg/mL, 50µg/mL, 75µg/mL and 100µg/mL) and results were compared with Vitamin C. Our results revealed that the fruits had a higher radical scavenging activity than the vegetables. Judging by the mean DPPH scavenging activity, apple (77.73%) and tomatoes (58.16%) exhibited the highest radical scavenging activity in the vegetable and fruit category respectively. Taken together, the samples selected for study all possessed anti-oxidant activity; therefore, consumption of these vegetables and fruits is encouraged.

Keywords: Antioxidant, Fruits, Vegetables, DPPH

1. Introduction

The search for affordable source of natural antioxidants have been of tremendous interest to scientist since the revelation that free radicals are responsible for a plethora of human diseases. Free radicals overwhelms the biological mechanisms and imposes oxidative stress on the system. Free radicals are produced by a multitude of sources which includes in vivo and environmental sources. Their deleterious effects abound and are evident in non-infectious diseases of public health concerns such as cancer, diabetes, neurodegenerative diseases to mention but a few [1]. The good news is that antioxidants can effectively mop up oxidants responsible for the pathogenesis of these diseases. This knowledge is largely responsible for the drive to identify, characterise and purify anti-oxidants from food sources to prevent oxidative stress in vivo as well serve as preserve to prevent deterioration of fats and other constituents of foodstuffs [2]. The potential to offer these two benefits mentioned above is referred to as Total Antioxidant

Potential (TAP). This potential is a relevant tool for investigating the relationship between dietary antioxidants and pathologies induced by the oxidative stress. This was confirmed by the data obtained from a recent population-based control study, proving that diet TAP resulted in reduced risk of both cardiac and distal gastric cancer [3].

Fruit and vegetable juices are rich sources of antioxidants and monovalent cations such as potassium. Recent scientific studies have also claimed that the antioxidants found in most fruits and vegetable juices can help lower a person's risks of developing Alzheimer's disease [4]. Vegetable juices, especially those that are low in calories, are effective in obesity treatment, because it attenuates hunger and allows water excess remove, due to the potassium salts [5].

In the infants and children foods, fruit and vegetable juices provides to the body the needs of mineral substances and vitamins[6].The fruit or vegetable juices with pulp are very important, they are being richer in nutrients, cellulose, pectic substances, than the clear juices. In the fruit and vegetable juices are found relatively high amounts of isothiocyanate,

phenolic, indoles and flavones that have a proven anti-cancer action. Epidemiological studies has consistently linked abundant consumption of fruits and vegetables to a reduction of the risk of developing several cancers. The mechanisms responsible for this chemopreventive effect still remain largely unknown but is likely related to the presence of phytochemicals associated with fruits and vegetables [7].

Lack of antioxidants, which can quench the reactive free radicals, facilitates the development of inflammatory diseases as well as other degenerative diseases [8]. One solution to this problem is to supplement the diet with antioxidant compounds that are contained in natural plant sources[9] These natural plant antioxidants can therefore, protect us like preventive medicine.

This study was designed to evaluate the comparative antioxidant activity of common fruits and vegetables in Dekina Local Government of Kogi State.

2. Method

2.1. Material

Fruits (Apple, watermelon, Sweet and Bitter Garden egg, Cucumber) and Vegetables (Spinach, Bitter leaf, Tomato,

Pumpkin leaf) samples were purchased from Anyigba market, Kogi State. They were washed, sliced, oven-dried to constant weight at 60°C. Fruits and vegetable were pulverized and stored at 4°C until when needed. Methanolic extract of the samples was prepared by making a 33% w/v suspension in methanol for 24 hrs after which the extracts were filtered and concentrated at 60°C.

2.2. DPPH (2,2Diphenyl 1 Pycrylhydrazyl)Radical Scavenging Activity

Antioxidant property of samples were accessed through DPPH radical scavenging assay according to a modified methods of [10], [11] and [12]. Methanol extract of each sample in graded concentrations (25µg/mL, 50µg/mL, 75µg/mL and 100µg/mL) were incubated with DPPH solution and allowed to stand in the dark for 20 min. Absorbance was taken using a Spectrophotometer at a wavelength of 577 nm and results were compared against standard antioxidant Vitamin C. Percentage inhibition of each sample was calculated according the formula [13] below:

$$\text{Percentage(\%)inhibition} = \frac{\text{Absorbance}_{\text{blank}} - \text{Absorbance}_{\text{sample}}}{\text{Absorbance}_{\text{blank}}} \times 100$$

2.3. Statistical Analysis

All statistical analysis was done on Microsoft excel 10.0

3. Results

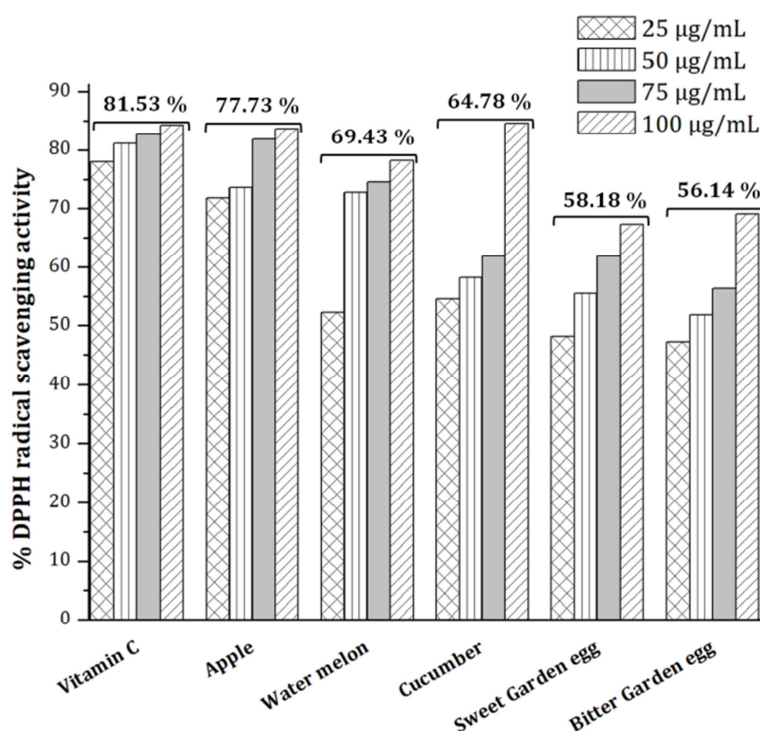


Figure 1. DPPH radical scavenging activity of selected fruits from Dekina Local Government Area, Kogi State, Nigeria. Overlying bars are the mean% DPPHradical scavenging activity.

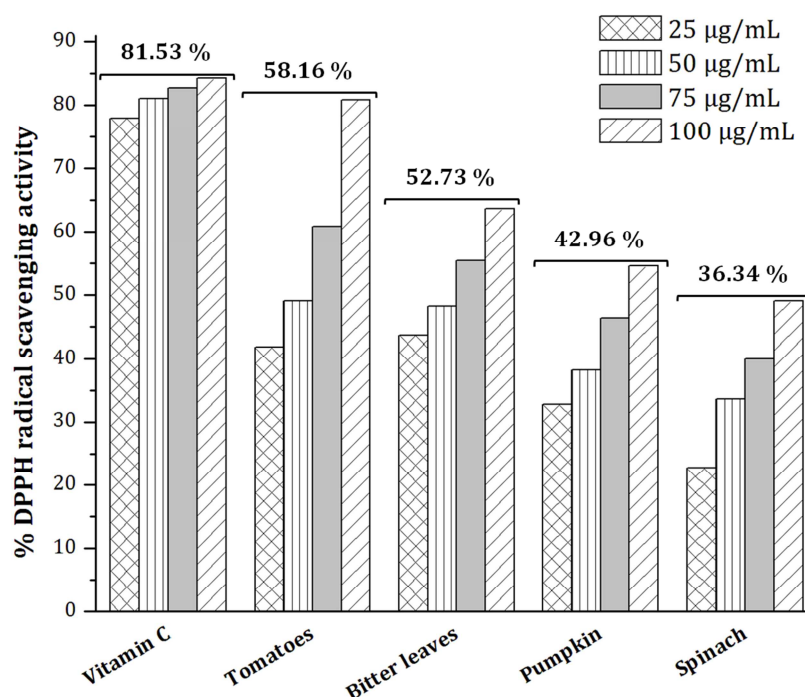


Figure 2. DPPH radical scavenging activity of selected vegetables from Dekina Local Government Area, Kogi State, Nigeria. Overlying bars are the mean% DPPH radical scavenging activity.

Five (5) fruits and four (4) vegetables were assessed for DPPH radical scavenging activity. Relative DPPH radical scavenging activity was determined by comparing the graded concentrations of the samples with the activity of Vitamin C assayed at similar concentrations. From the results of this study presented in Figures 1 and 2 all samples tested scavenged the DPPH radical in a concentration dependent manner. Judging by the mean scavenging activities, fruits were better antioxidants than vegetables. From the category of fruits apple had the highest activity of 77.73% ranking second and comparable to Vitamin C, 81.53% (Figure 1). The two variety of garden eggs tested had the least antioxidant activity; their mean activity values were identical but with the sweet variety been slightly more active (58.18%). Similarly, tomatoes and spinach had the highest (58.16%) and least (36.34%) activities respectively. Summarily, the observed trend for the activities of the fruits tested was Vitamin C > Apple watermelon > Cucumber > Sweet garden egg > Bitter garden egg. While the trend for vegetables was Vitamin C > Tomato > Bitter leaves > Pumpkin leaves > Spinach.

4. Discussion

In recent times, many epidemiological studies have confirmed that intake of exogenous antioxidants is effective in the prevention of a number of human diseases which have been implicated to be due to oxidative stress [14] and [15]. Synthetic antioxidants such as free fatty acids, 2,3-ter-butyl-4-methoxyphenol (BHA), 2,6-di-ter-butyl-4-methylphenol (BHT) and tert-butylhydroquinone (TBHQ) are known to prevent oxidative stress related diseases [16] and [17], but unfortunately, they have been proven to be toxic in chronic

administration [17], as evidenced by severe hemorrhage in rabbit after chronic administration of BHT [14]. Consequently, the necessity for investigation and evaluation of safer antioxidants from natural sources becomes imperative. Antioxidants isolated from the plant and fruit sources have proved to be safer even in chronic administration. Fruits, vegetables and oil seeds have increasingly been recognized as sources for antioxidant phenolics [18] and [19]. Anecdotal evidence suggests that fruits such as apple, watermelon, cucumber, and garden eggs are useful in this regard. These fruits could be munched or chewed for their different health benefits. The order of antioxidant activity based on values, Vitamin C > Apple watermelon > Cucumber > Sweet garden egg > Bitter garden egg, while that of the vegetables showed Vitamin C > Tomato > Bitter leaves > Pumpkin leaves > Spinach (Figures 1&2; $P < 0.05$), showed similarity to the work of Edet and co-workers; looking at fruits consumed in Calabar, Nigeria [20], as well as that of Chen and colleagues [21]. Liano and co-workers reported similar trend in the antioxidant properties of apple and watermelon [18]. Interestingly, the % inhibition (Figures 1&2), which was concentration dependent, could be interpreted to mean that higher consumption of these fruits leads higher health benefits. A study by Prior, encourages high consumption of fruits for health benefits [22].

These fruits are characterised with secondary metabolites, such as anthocyanin, proanthocyanidine, phenol, glycosides, and flavonoids, which possess hydroxyl groups responsible for free radical scavenging effect [23] [24] and [25]. It has been known that flavonoids possess antioxidant activity, and thus considered beneficial to human health and nutrition [26]. Phenolic compounds act as free radical chain reaction terminator; thereby acting as antioxidant. Phenol also have

a potential of combating oxidative stress, a syndrome causative of some neurodegenerative diseases and cardiovascular diseases[27] and [28]. Phenolic compounds comprise a large group of biologically active substances [29]. Quercetin, catechin, ferrulic acid, caffeic acid, gallic acid, coumaric acid, and rutin, are among the most common naturally occurring antioxidant phenolic compounds in fruits. Other natural antioxidants include glutathione peroxidase, superoxide dismutase, tocopherols, and vitamin C, and carotenoids[30]. The level of antioxidant as evidenced in this study could speculate the presence of phenolics. This could mean polyphenolic compounds were responsible for the potent DPPH scavenging activity. It is beyond the scope of this study to quantify and evaluate the phenolic and the flavonoid content of these fruits. However, for emphasis, studies attest to their presence [31] [32] and [33]. Furthermore, the mechanism of action of flavonoids, which are through scavenging or chelating process[34] could synergistically involve phenolics and other antioxidant metabolite to demonstrate the scavenging activity expressed by the fruits.

5. Conclusion

The result shows that fruits and vegetables are good sources of antioxidant. It was also confirmed that fruits possess higher antioxidant activity than vegetables.

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