Research Paper

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Comparative study of antioxidant and micronutrient properties of four selected Nigerian fruits

Home Science

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ABSTRACT

The antioxidant and micronutrient composition of fresh samples of Parkia biglobosa, Landophia orensis, Sterculia trycantha and Dacryodes edulis were investigated and compared. The mesocarp of fresh samples of the fruits as consumed were analysed using standard analytical methods. The fruits had vitamin A (0.14mg/100g - 4.48mg/100g), ascorbate (21.90mg/100g - 189.97mg/100g), vitamin E (0.13mg/100g - 6.73mg/100g), Zinc (0.16mg/100g - 1.52mg/100g) and iron (0.85mg/100g - 2.78mg/100g). Parkia biglobosa had significantly higher levels of ascorbate and vitamin E ($P < 0.05$) while Dacryodes edulis had significantly higher level of vitamin A ($P < 0.05$) and higher levels of zinc and iron. The study confirmed fruits as good sources of antioxidants. Nutrition education on the micronutrient and antioxidant potentials of fruits is therefore advocated to make them more popular and acceptable to the population.

INTRODUCTION

Antioxidants are a diverse group of chemicals naturally found in vegetables, fruits and plants in general, which fight diseases and help body cells and tissues stay healthy (Blomhoff, 2005). Their primary action is the mopping up of harmful free radicals (oxidants) from body cells and tissues (Tannenbaum, Wishok and Leaf, 1991, Ene-obong, 2001, Bensie, 2003, Stammers, 2004).

Lately, the menace of genetic mutation due to the intake of processed foods raises the possibility of the accumulation of free radicals and therefore poses danger to the achievement of optimum health for the world's population as advocated by different governments. The adoption of western lifestyles ranging from diet to sedentary behaviours by populations of developing countries and a neglect of the consumption of sources of antioxidants especially fruits and vegetables have in no small way contributed to the prevalence of some non-communicable health problems which otherwise were alien to their environment. It is now established that free radicals especially Superoxide (O_2^-), nitric oxide ($NO^\cdot$) and other reactive species such as hydrogen peroxide (H_2O_2) are continuously produced in vivo (Halliwell and Gutteridge,1989; Ames, 1983; Moncada and Higgs,1993).

Fruits and vegetables contain elements which have been proven to have antioxidant and phytochemical properties (Hennekens,1986). These include the carotenoids which have been credited with antioxidant and singlet oxygen scavenging abilities (Ames,1983). Of these, Beta (β) carotene is considered to be the most effective singlet oxygen quencher known (Krinsky,1991). β-carotene acts as a soluble chain-breaking antioxidant at a low partial pressure of oxygen while its complement; tocopherol is a very effective antioxidant at higher oxygen pressures. Other antioxidants which occur in fruits and vegetables include lycopenes, ascorbic acid, zinc and selenium.

The major antioxidant nutrients are vitamins A, C, E, and selenium (Anderson, Teuber and Gobeik, 2001). Antioxidants have been known to play an integral role in normal human metabolism by providing a defensive mechanism against the damaging effects of reactive free radicals and singlet oxygen which are always consequences of normal aerobic metabolism in eukaryotic cells especially in biological systems containing polyunsaturated fatty acids where the change they induce can be greatly magnified by a chain reaction involving peroxyl radicals (Byelakoric et al.,2007).

Antioxidants by acting as scavengers of harmful oxygen derived free radicals assist to prevent cell and tissue damage that precipitate diseases including cancers (Bensie, 2003). Packer and Cadenas (1985) explained that plant based diets may have a protective role against diseases such as cardiovascular diseases and other cancers due to the antioxidant activity of their contents.

Apart from their free radical and singlet oxygen scavenging ability, antioxidants also boost the immune system by playing important roles in angular metabolism, signal transduction, gene activation and gene transcription. These antioxidants which at times occur as micronutrients in fruits and vegetables are not adequately consumed due to ignorance of their potentials. Therefore, this study was designed to determine and compare the antioxidant and other micronutrient properties of four Nigerian fruits.

MATERIALS AND METHODS

Materials: The four Nigerian fruits selected for this study; African pear (*Dacryodes edulis*), Ugba (*Parkia biglobosa*), Ekpuruamu nwa ebule (*Sterculia trycantha*) and Utu (*Landophia orensis*) were procured from a local market in Nsukka, Enugu State, Nigeria.

Sample processing: Fresh samples of the selected fruits were washed and their respective pulps scooped into separate containers for immediate chemical analysis. All the chemical analyses were done in triplicates.

Chemical analysis: The vitamin A content of each of the samples was determined using Pearson (1976) procedure while vitamin C, vitamin E, zinc and iron were determined using the AOAC (1995) procedures.

Statistical analysis: The Statistical Package for Social Sciences (SPSS) computer software, version 17 was used to analyse the data. Descriptive statistics such as percentage, mean and standard deviation and standard error of the mean were computed for each sample while Duncan's Studentised New Multiple Range Test was used to separate and compare means at 5% level of significance.

RESULTS AND DISCUSSION.

Table 1: Mean levels of vitamins A, C and E in the samples (per 100g as consumed).

Sample	Vitamin A(mg/100g)	Vitamin C(mg/100g)	Vitamin E(mg/100g)
Dacryodes edulis	4.48 ± 0.18^{b}	23.81 ± 0.04^{a}	0.56 ± 0.04^{ac}
Landophia orensis	0.14 ± 0.01^{a}	21.90 ± 0.00^{a}	0.56 ± 0.04^{ac}

Parkia biglobosa	0.29 ± 0.01[a]	189.97 ± 0.06[b]	82.03 ± 0.04[b]
Sterculia trycantha	0.42 ± 0.00[a]	82.03 ± 0.04[a]	0.13 ± 0.03[ac]

Note: Values were given as Mean + S.D of 3 determinations.

Values in the same column with different superscripts are significantly different (P < 0.05)

The levels of vitamins A, C and E in the samples were shown in table 1. *Dacryodes edulis* contained the highest level (4.48mg/100g) of vitamin A (P < 0.05) while *Parkia biglobosa* had the highest levels (189.97mg/100g and 82.03mg/100g) of vitamin C and vitamin E respectively (P< 0.05). The vitamins A,C and E composition of the fruits indicate that their ample consumption can lower the risk of chronic diseases (Hennekens, 1986, Kendall, 2000). The levels also validate the report of Winston (2004) that vegetarians had higher dietary antioxidant nutrient intake than non-vegetarians.

Table 2: Zinc and iron composition of the samples (per 100g as consumed).

Sample	Zinc (mg/100g)	Iron (mg/100g)
Dacryodes edulis	1.52 ± 0.01[a]	2.78 ± 0.01[a]
Landophia orensis	0.35 ± 0.06[a]	1.40 ± 0.02[a]
Parkia biglobosa	0.40 ± 0.00[a]	0.85 ± 0.01[a]
Sterculia trycantha	0.16 ± 0.01[a]	1.51 ± 0.01[a]

Note: Values were reported as mean ± S.D

Values in the same column with different superscripts are significantly different (P < 0.05).

The zinc and iron contents of the samples were shown in table 2. *Dacryodes edulis* had the highest composition (1.52mg/100g and 2.78mg/100g) of zinc and iron.

Dacryodes edulis is therefore a better source of zinc and iron than the other fruits. Zinc plays a vital role in nucleic acid synthesis, protein digestion, protein synthesis, carbohydrate metabolism and bone metabolism (Vanway,1992). It also plays a role in oxygen transport and protection against free radical damage (Garrow, James and Ralph,1998). Zinc is a component of over 300 enzymes involved in the synthesis and degradation of carbohydrates, lipids, proteins, and nucleic acid. It is also involved in the metabolism of micronutrients and in the maintenance of cell and organ integrity and the immune system (Shankar and Prasad,1998). Higher levels of vitamin A and zinc in *Dacryodes edulis* also agrees with SCN (1995) that zinc deficiency most times occur with vitamin A deficiency. The high level of zinc would be of great relevance in the absorption of vitamin A and its mobilisation from the liver. The higher level of iron in *Dacryodes edulis* is also not surprising as zinc deficiency is often closely associated with iron deficiency. Iron plays vital roles in immune function, cognitive development, temperature regulation, energy metabolism and work performance.

CONCLUSION:

The results of the study suggest that the antioxidant nutrients requirement of the population can be met through an ample consumption of fruits and vegetables.

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