*Int. J. Pure Appl. Sci. Technol.*, 29(1) (2015), pp. 20-25

***International Journal of Pure and Applied Sciences and Technology***

***ISSN 2229 - 6107***

*Available online at* ***www.ijopaasat.in***

***Research Paper***

# Analysis of Nutrients, Total Polyphenols and Antioxidant Activity of Gingerbread Plum (*Neocarya Macrophylla*) Fruits from Sokoto

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(Received: 24-4-15; Accepted: 1-7-15)

**Abstract:** *Ripe fruits of Gingerbread plum (Neocaryamacrophylla) were evaluated for crude protein, minerals content, total polyphenols and antioxidant activity. The total polyphenols content of methanol extract was relatively high (670.82±0.21mg/100g garlic acid equivalent), the scavenging power of the extract was 56.87±4.11% and the crude protein content of the fruit pulp was 10.39±2.11% dry weight. The fruit pulp also contained 12.80±2.98mg/100g Na, 180.02±3.99mg/100g K, 179.61± 7.58mg/100g P, 304.99±1.76mg/100g Ca, 821.56±2.77mg/100g Mg, 3.88± 1.14mg/100g Zn, 2.11±0.89mg/100g Fe and 0.89±0.21mg/100g Mn on dry weight basis. The results show that the fruit pulp is rich in essential mineral elements that have a positive effect on human health. The results also support the use of the fruit as supplement for nutrient deficiencies and for combating diseases associated with oxidative damage.*

**Keywords:** *Neocaryamacrophylla*, total polyphenols, wild fruits, antioxidant activity.

## Introduction

The use of wild foods, of which wild fruits form a part as component of local responses to increasing food insecurity is widely documented (Gatachew *et al*., 2005). In many tropical countries, rural people traditionally harvest a wide range of roots, tubers and edible fruits from the wild because of their taste, cultural uses, as food supplements and to alleviate food shortages (Mahapatra *et al*., 2012).

Native edible wild fruits can play a crucial role in combating food insecurity, especially the so-called hidden hunger caused by micronutrients, vitamins and minerals deficiencies (Motlhanka and Makhabu, 2011). The macro and micro elements composition of well-known tropical fruits such as banana, orange, mango, apple and others have been reported (Aremu and Udoessien, 1990). In Nigeria many wild fruits such as *Adensoniadigitata*, *Sclerocaryabirrea*, and *Zizophussonorensis* are harvested from the wild to support nutritional needs of the rural communities (Marcelino*et al*., 2005). Studies on nutritional analysis of some wild fruits growing in rural countryside of many developing nations, have reported better nutritional values than commercially cultivated fruits such as mangos oranges and bananas (Eromosele *et al*., 1991). As a result, a growing interest has emerged to evaluate various wild edible fruits for their nutritional value (Aberounmand and Deokule, 2009). Besides nutrition, fruits are also valuable sources of bio-active compounds such as flavonoids, phenolic acids and free radical scarvengers (King *et al*., 2006). Many studies suggest that regular or moderate intake of food rich in polyphenols is known to have several health promoting properties such as lowering the risk of several oxidative stresses including cardiovascular diseases, cancer, stroke and ageing (Willet, 2002).

Gingerbread plum (*Neocaryamacrophylla*) commonly known as "*Gawasa*" in hausa language belongs to *Chrysobalanaceae*family. It is grown in arid and semiarid regions mainly in the Western part of Africa. The plant is semi-cultivated in Northern part of Nigeria and its fruits are harvested from the ground (Amza *et al*., 2011). The fruits are used in variety of ways. Many are eaten fresh or boiled with cereals. Fragrant syrups are prepared and proved to be much stronger than some fruit juice (Amza *et al*., 2011).

**Plate 1:** Riped *Neocaryamacrophylla* fruits

Fredrick (1961), Cook *et al*., 1998, and Audu*et al*., 2005 reported the nutritional and functional characteristics of *Neocaryamacrophylla* fruits. Nutritional and health information of *Neocaryamacrophylla* fruits obtained from Sokoto State is very scanty. The present study therefore, is aimed to evaluate the nutrient and total polyphenols content of *Neocaryamacrophylla* fruits from Sokoto State, Nigeria in order to validate its potential in improving health and food security for the rural communities.

## Materials and Methods

## Sampling and Sample Treatment

Fresh fruits of *Neocaryamacrophylla* were collected from Wamakko Local government, Sokoto State, Nigeria. Five (5) trees were randomly selected and only ripped fruits were collected from different

branches of the trees, as described by Hassan and Umar (2004).The sample was collected in black polythene bags and transported to laboratory. Prior to analyses, the sample was authenticated at the Herbarium section, Botany Unit, Usmanu Danfodiyo University, Sokoto, Nigeria. Representative sample was taken using alternate shovel method (Alan, 1996).The sample was thoroughly washed with distilled water and then air dried.

## Preparation of the Extract

After drying, the fruits pulp was removed and crushed into powder with the help of pestle and mortar. Fifty grammes (50g) of the powdered pulp were then soaked into 500cm$^3$ methanol and allowed to stand for four days at 4$^0$C. The extract was centrifuged at 1000rpm for 5minutes, filtered and then concentrated to dryness using rotary evaporator. The percentage extract was calculated using equation 1.

$$\% \text{ Extract} = \frac{\text{Weight of extract}}{\text{Sample weight}} \text{x} 100 \text{.....(1)}$$

The residue obtained was kept at 4$^0$C until when required (Motlhanka *et al*., 2012).

## Determination of Minerals and Crude Protein

Mineral analysis was carried out after sample digestion of 2g of the dried pulp with 24cm$^3$ mixture of nitric acid/perchloric/sulphuric acids in the ratio 9:2:1 respectively. Ca, Mg, Fe, Co, Mn, Zn were determined by atomic absorption spectrophotometry, Na and K by atomic emission spectrometry (AOAC, 1990), and P by the molybdenum blue colorimetric method (James, 1995).

The nitrogen (N) content was estimated by micro-Kjeldahl method and crude protein (CP) content calculated as N% x 6.25 (AOAC, 1990).

## Determination of Total Polyphenols

Total polyphenols content in the extract were estimated using the modified Folin-Ciocalteu method(Motlhanka *et al*., 2012). The extract (20uL) was mixed with 100uL Folin-Ciocalteu reagent in clean cuvettes and mixed well. Then 300uL of 0.2uL Sodium carbonate was added. The cuvettes were vortexed for 15seconds and allowed to stand for 30minutes at 40$^0$C for color development. Absorbance was then measured at 765nm using Hewlett Packard UV-Visible spectrophotometer. The total polyphenols content was determined from the calibration curve and presented as Garlic acid equivalent in mg/100g.

## DPPH Radical Scavenging Assay

Free radical scavenging activity of the extract was measured in terms of 1,1-diphenyl-2-picrylhydrazyl (DPPH). A 0.1mMsolution of DPPH in methanol was prepared and 1.0cm$^3$ of this solution was added to 0.5cm$^3$ of the extract. The absorbance was measured after 20minutes at 525nm (Motlhanka *et al*., 2012). The % scavenging activity of the extract was calculated using the following formula given in equation 2.

$$\text{DPPH radical scavenging activity (\%)} = \frac{\text{ABS}_{\text{Blank}} - \text{ABS}_{\text{Sample}}}{\text{ABS}_{\text{Blank}}} \text{ x } 100 \text{.....(2)}$$

Where $ABS_{Blank}$ is the absorbance of DPPH radical in methanol; $ABS_{Sample}$ is the absorbance of DPPH radical + sample.

## Statistical Analysis

The Data obtained were statistically analyzed using one way analysis of variance (ANOVA) with SPSS version 10.0 statistical package and the results were expressed as mean ± standard deviation of three replicates.

## Results

## The Percentage Yield

The percentage yield of the extract was 15g/100g of the fruit pulp which is an indication that the pulp contains some important nutritional or medicinal phytocompounds.

## Crude Protein and Minerals Content

The crude protein content of the pulp was 10.39 ± 2.11g/100g dry weight. The minerals content is presented in Table 1 below.

**Table 1:** Minerals Content of *Neocaryamacrophylla* fruit pulp (mg/100g dry weight)

| Mineral Element | Concentration |
|---|---|
| **Na** | 12.80 ± 2.98 |
| **K** | 180.02 ± 3.99 |
| **Ca** | 304.99 ± 1.76 |
| **Mg** | 821.56 ± 2.77 |
| **P** | 179.61 ± 7.58 |
| **Zn** | 3.88 ± 1.14 |
| **Fe** | 2.11 ± 0.89 |
| **Mn** | 0.89 ± 0.21 |

The Values are mean ± standard deviation

## Total Polyphenols Content and DPPH Scavenging Activity Assay

The total polyphenols content of the fruit pulp was 670.82 ± 7.21mg/100g and the DPPH scavenging assay was 56.87 ± 4.11%.

## Discussion

## Crude Protein and Minerals Content

The fruit pulp contains relatively low protein (10.39 ± 2.11g/100g) which is known for growth and repairs of worn-out tissues. The value obtained is higher compared to 8.5g/100g in the pulp of *Zizyphussonorensis* fruits reported by Marcelino *et al*. (2005).

The minerals profile of the fruit pulp is reported per 100g dry weight basis and the result presented in Table 1. Minerals in any diet are required for proper growth and good health (Ali and Deokule, 2009). Magnesium is the most abundant (821.56 ± 2.77mg) element in the pulp followed by calcium (304.99 ± 1.76mg) and then potassium (180.02 ± 3.99mg), phosphorus is also relatively high (179.61 ± 7.58mg/100g). Calcium and phosphorus are important in the proper development of bones and teeth. The high calcium content makes the fruit pulp attractive as a natural source of calcium supplementation for pregnant and lactating women, as well as for children and the elderly people

(Tidjani *et al*., 2010), while potassium and sodium are important body electrolytes which help in maintaining proper acid-base balance and transmission of nerve impulses (Oshodi *et al*., 1999). High concentration of magnesium in the *Neocaryamacrophylla* fruit pulp is an indication that it could be a good source of magnesium which is known to activate many enzymes systems, responsible for calcium metabolism in bones and in the maintenance of electrical potential in nerves (Ishida *et al*., 2000).

The *Neocaryamacrophylla* fruit pulp analyzed contains appreciable quantity of zinc (3.88.77 ± 1.14mg/100g), iron (2.11 ± 0.89mg/100g) and manganese (0.89 ± 0.21mg/100g) which are important micro elements required by body for proper functioning. For example, Manganese is known to support the immune system, regulate blood sugar levels and is involved in the production of energy and cell reproduction (Melaku *et al*., 2005). Iron is utilized in the body for transportation of oxygen to the tissue, maintenance of oxidative enzymes system within the tissue cells and melanin formation (House, 1999) and Zinc is known to play an important role in gene expression, regulation of cellular growth and participates as a co-factor of enzymes responsible for carbohydrate, proteins and nucleic acid metabolism (Camara and Amaro, 2003).

## Total Polyphenols Content and DPPH Scavenging Activity Assay

Polyphenolic compounds are a class of antioxidant agents which act as free radical terminators (Das and Pereira, 1990). The total polyphenols content of the extract was 670.82 ± 7.21mg/100gDW garlic acid equivalent. The value obtained is relatively higher than the total polyphenols content of *Mangiferaindica* fruit pulp (580.91mg/100gDW)reported by Abubakar *et al*. (2013). The high polyphenols content of the fruit pulp may be an added value to its nutritional and medicinal potential.
Free radicals which are involved in the process of lipid peroxidation are considered to play a major role in numerous chronic diseases such as cancer and cardiovascular diseases. A compound with radical reducing power may serve as a potential antioxidant (Motlhanka *et al*., 2012). The DPPH radical activity of the methanol extract was 56.87 ± 4.11%. The high antioxidant activity observed might be due to the presence of phenolic compounds.

## Conclusion

The results obtained indicate that*Neocaryamacrophylla* fruits pulp are nutritionally rich in terms of minerals and crude protein composition. The consumption of these fruits may help overcome nutrient deficiencies that are prevalent in poor and rural areas. The high polyphenols content with high antioxidant activity further increases their potential as tools for combating diseases associated with oxidative damage.

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