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THE DETERMINATION OF THE NUTRIENT AND PHYTOCHEMICAL COMPOSITION OF FRESH CARROT (*Daucus carota*) LEAVES

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ABSTRACT

Fresh carrot (*Daucus carota*) leaves were randomly collected from five stalls in Jimeta main Market, Yola State, Nigeria. The leaves were inspected and sorted. The leaves that were fresh, green and free from insect damage were selected. Samples were taken immediately for moisture analysis, while the rest were dried for three days using solar dryer. Milling was done using attrition milling machine. The proximate and vitamin content of the samples were determined using standard AOAC methods. Mineral elements were determined using wet-acid digestion method for multiple nutrients determination. All tests were carried out in duplicates and the data generated were analysed using standard methods. The fat, ash, crude fiber, crude protein values of the sample were 1.08, 3.37, 3.62 and 6.72g/100g. The carrot leaves contain ascorbic acid (59.45mg/100g) vitamin B_1 (0.15mg/100g), vitamin B_2 (0.37mg/100g), vitamin B_3 (0.16mg/100g) and vitamin E (8.04mg/100g). All the macro mineral determined were low. The vegetable contained iodine (14.16mg/100g), iron (1.07mg/100g), and zinc (0.05mg/100g). Carrot leaves contains ascorbic acid (59.45mg/100g) vitamin B1 (0.15mg/100g), vitamin B_2 (0.37mg/100g), vitamin B_3 (0.16mg/100g) and vitamin E (8.04mg/100g). Tannin (9mg/100g), flavonoids (16mg/100g), alkaloids (963mg/100g), saponin (58mg/100g), phenol (17mg/100g) and sterol 2mg/100g). The result shows that fresh carrot leave is a good source of vitamins C, E and iodine. It also has substantial quantity of the B-vitamins. The chemical profile of fresh carrot leaves showed that it can be an alternative for most common vegetables.

Keywords: *Daucus Carota* Leaves, Vitamin C, Iodine, Phytochemicals, Vitamin E

INTRODUCTION

The present uncertainty in the world food supply and the expected increase in demand, warrant the search for alternative sources of food (Fowomola, 2010). Increase in demand in the face of food shortage result in high incidence of malnutrition and increase dietary disease (Bello *et al.*, 2008). Carrot (*Daucus carota*) is usually surplus in Nigeria when in season; only its root is utilize as food. Carrot root is best known for its beta carotene content. It contains between 600 and 54,000 micrograms carotenoids per 100g of carrot root (Rubatsky *et al.*, 1999). In addition, it is a good source of biotin, vitamin k, dietary fiber, potassium, vitamin B6, vitamin C, copper, vitamin E, folate, vitamin B_2 and manganese (Matykova and Petrikova, 2010). Record shows that the green leafy part of carrot is edible (Rubatsky *et al.*, 2010); in Nigeria however, the green leafy part of carrot is usually discarded as waste. Knowing the nutritional composition of carrot leaves may enhance its use as alternative, low-cost source of nutrients that may increase the nutritional used value of the diet of poor people. This study is therefore designed to evaluate the nutrient and phytochemical composition of carrot leaves.

MATERIALS AND METHODS

Collection/Preparation of Carrot Leaves for Chemical Analysiss

Fresh carrot leaves were randomly collected from five stalls in Jimeta Main Market, Yola State, Nigeria. The leaves were inspected and sorted. The leaves that were fresh, green and free from insect damage were selected. Samples were taken immediately for moisture analysis, while the rest were dried for three days using solar dryer. Milling was done using attrition milling machine (Thomas Wiley Model ED-5) with screen aperture of 5mm. The milled samples were stored in air-tight containers and stored in the refrigerator until needed for chemical analysis.

Chemical Analyses

The moisture content of carrot leaves was determined using standard A.O.A.C. (2006) method. The fresh leaves and the solar dried leaves were dried in a moisture extraction oven at 105°C in order to determine actual moisture and residual moisture contents, respectively. The drying of the vegetable sample for milling into powder was done at 55°C. The actual moisture content of the fresh fruit and the residual moisture of the samples were used to calculate the moisture conversion factor (WCF) which was used to obtain the nutrient composition of the vegetable. Two (2) grams of both the fresh and dried samples of the pulp were weighed separately into previously weighed moisture

crucibles. The samples were dried in a moisture extraction oven at 105°C for 3 hours. The crucibles were cooled in desiccators and weighed. The process of drying and cooling was continued until a constant weight is obtained. The crude protein content was determined by micro-Kjeldahl method, using 6.25 as the nitrogen conversion factor. The crude fat content of the juice sample was determined by Soxhlet extraction method using petroleum ether. The ash content was determined by incinerating the samples at 600°C in a muffle furnace. Carbohydrate was obtained by difference, while energy was calculated using the Atwater Conversion factors in KJ and Kcal (17KJ/4Kcal, 17KJ/4Kcal, and 37KJ/9Kcal, for protein, carbohydrate and lipid respectively.

Mineral elements were determined using wet-acid digestion method for multiple nutrients determination as described by the method of A.O.A.C (2006). About 0.2g of the processed sample material was weighed into a 150ml Pyrex conical flask. Five (5.0) ml of the extracting mixture (H_2SO_4 – Sodium Salicylic acid) was added to the sample. The mixture was allowed to stand for 16 hours. The mixture was then placed on a hot plate set at 30°C and allowed to heat for about 2hours. Five (5.0) ml of concentrated perchloric acid was introduced to the sample and heated vigorously until the sample was digested to a clear solution. Twenty (20) ml of distilled H_2O was added and heated to mix thoroughly for about a minute. The digest was allowed to cool and was transferred into a 50ml volumetric flask and made up to the mark with distilled water. The digest was used for the determinations of calcium (Ca) and magnesium (Mg) by the ethylamine ditetraactic acid (EDTA) versanate complexiometric titration method. Potassium (K) and sodium (Na) were evaluated by flame photometry method and phosphorus (P) by the vanadomolybdate method using the spectrophotometer. The trace metals (zinc, iron, copper, selenium, manganese and iodine) were determined using the atomic absorption spectrophotometer 969 instrument. The appropriate cathode lamp was fixed for each element. The sample was introduced to the atomizer and the value concentration of the element printed out as mgX/liter. The actual values were calculated as mgX/kg of the sample. Ascorbic acid was determined as described by A.O.A.C (2006) using titration method. Gravimetric method (Harborne, 1973) was used to determine alkaloids. Saponin was determined by gravimetric oven drying method as described by the method of A.O.A.C (2006). Tannin content of the sample was determined spectrophometrically as described by Kirk and Sawyer (1991). Phenol was determined by the folin-ciocatean spectrophotometry method (A.O.A.C 2006). Flavonoid was determined by gravimetric oven drying method as described by Harborne (1973).

STATISTICAL ANALYSIS

All determinations were done in duplicates. The data generated were entered into the computer and analyzed using Statistical Package for Social Sciences (SPSS version 16.0) Means and standard deviation obtained from the chemical analysis were calculated.

RESULTS AND DISCUSSIONS

The proximate composition of fresh carrot leaves is shown on Table 1. The moisture content of fresh carrot (*Daucus carota*) leaves was 70g/100g; this value fell within values reported in literature for fresh green leafy vegetables (FAO 2006; Stadimayr *et al.,* 2012). The moisture content (70g/100g) of fresh carrot leaves was higher than the values (56.9g/100g, 58.05g/100g) reported for *Gongronenema latitolium* and *Gnetum africanum* (Nnam *et al.*, 2012). However, the moisture content of carrot leaves (70g/100g) was lower than those of *Amaranthus aquatica* (Oguche, 2011) and *Telferia occidentulis* (84.47% and 86g/100g respectively). The crude protein and ash values (6.72%, 3.57%) of fresh carrot leaves were comparable to crude protein and ash (6.1%; 3.9%) values, reported for amarantus (Adepoju *et al.*, 2006) but lower than (9.19%; 11.90% reported for *Abelmoschus esculentus* (Zoro *et al.*, 2013). The low crude protein found in fresh leafy carrot was not surprising because green leafy vegetables are generally poor source of plant protein. The crude fiber (3.62%) and crude fat (1.08%) values fell within values reported for most fresh green leafy vegetable (Ejoh *et al.*, 1996; Stadimayr *et al.,* 2012). The crude fat content of the vegetable will supply 1.10% caloric energy to the body; and this is recommended (Kris-Etherton *et al.*, 2002). Although the fibre content of carrot leave is low, its presence can contribute to the prevention of colon cancer and in the treatment of diseases such as obesity, diabetes and gastrointestinal disorders (Saldanha, 1995; UICC/WHO, 2005). The carbohydrate and energy values of the vegetable were 15.21% and 412.8KJ respectively. The low energy, high moisture, low fat and low protein make the vegetable suitable for patients with some physiological conditions.

The result of the macro mineral composition of carrot leaves on Table 2. The leaves contain calcium (4.63mg/100g), magnesium (2.82mg/100g), potassium (5.90mg/100g), sodium (10.72mg/100g). Though the macronutrient contents of fresh carrot leaves were observed to be generally low, its macronutrients were however higher than values reported for some indigenous fresh green leafy vegetables in Nigeria (Stadimayr *et al.,* 2012). The micronutrient composition of fresh carrot leaves on Table 2 showed that it contains zinc (0.05mg/100g),

and iron (1.07mg/100g). The zinc value (0.05mg/100g) of fresh carrot leaves was comparable to that of apple (0.04-0.05mg/100g) and that of grape fruit (0.07mg/100g). The iron value (1.07mg/100g) of the vegetable was higher than those of fresh ripe tomatoes (0.6mg/100g), cucumber raw (0.5mg/100g), lettuce raw (0.8mg/100g) but comparable to that of pepper chill raw (1.1mg/100g). The iodine content of fresh carrot leaves was 14160mg/100g. The recommended daily iodine intake for adult is 150mg/d (Wardlaw and Hampls, 2007). This implies that intake of less than 4g of fresh carrot leaves can supply adults with more than their daily iodine needs. The vitamin composition of fresh carrot leaves are shown on Table 3. Most of the vitamin values of the fresh carrot leaves were many folds higher than the values reported for most vegetable published in the West African Food Composition Table (Staimaryr *et al*., 2012). Carrot leaves contains vitamin C (59.45mg/100g), vitamin B_1 (0.16mg/100g), vitamin B_2 (0.37mg/100g), vitamin B_3 (0.16mg/100g) and vitamin E (8.04mg/100g). The vitamin C in carrot leaves will enhance the absorption of plant iron in human (Ene-Obong, 2001), and the B-vitamins in it will play significant roles in energy metabolism and several body function. The vitamin E value (8.04mg/100g) was also significantly higher than the ones reported for most common vegetables. The recommended daily vitamin E intake for adult is 15mg/d; this implies that 8.04mg/100g found in fresh carrot leaves can supply about 53.6% adult daily vitamin E need.

The phytochemical/antinutrient composition of fresh carrot leaves is shown on Table 4. Fresh carrot leaves contain tannin (9mg/100g), flavonoids (160mg/100g), alkaloids (963mg/100g), saponin (58mg/100g), phenol (17mg/100g) and sterol 2mg/100g). Phytochemicals are plant component that help to protect plants (Adefegha and Oboh, 2013). Some of them contributes to reduction of risk of cancer or heart disease (Bruce, 2000), while others block the carcinogenic process (Rao and Agarwal, 1999). The presence of phytochemical in fresh carrot leave is an indication of its health benefit. Also the values of antinutrient (tannin, alkaloids, saponins and phenols) found in the samples were less than 1% which means that the quantity antinutrient in the samples may be too small to cause any harm in the body (Anigo *et al*., 2010).

CONCLUSION

The protein, fat, ash, carbohydrate composition of fresh carrot leaves was comparable to those of most common fresh green leafy vegetables. The result shows that fresh carrot leave is a good source of micro-mineral but poor source of macro-minerals. The vegetable is rich in vitamin C and E and has substantial quantity of the B-vitamins. The chemical composition of fresh carrot leaves

showed that it can be an alternative for most vegetables and it can make substantial contribution to vitamin C, vitamin E, vitamin B_2 and iodine intakes.

RESULTS

Table 1: Energy and Proximate Composition of fresh carrot (*Daucus carota*) leaves

Nutrient	Fresh carrot l eave s
Moisture (g/100g)	70± 0.0.16
Crud fat (g/100g)	1.08± 0.00
Crude protein(g/100g)	6.72 ±0.01
Ash (g/100g)	3.37 ±0.00
Crud fiber(g/100g)	3.62 ±0.00
Available CHO (g/100g)	15.21 ±0.03
Energy(kcal/KJ)	97.44/412.8

Table 2: Mineral Composition of fresh carrot (*Daucus carota*) leaves.

Mineral	Fresh carrot l eave s
Calcium (mg/100g)	4.63 ±0.02
Magnesium(mg/100g)	2.82 ±0.07
Potassium(mg/100g)	5.90 ±0.03
Iodine(mcg/100g)	14160 ±0.21
Iron(mg/100g)	1.07 ±0.07
Zinc(mg/100g)	0.05 ±0.01
Sodium(mg/100g)	10.72 ±0.02

Table 3: Composition of fresh Carrot (*Daucus carota*) leaves (mg/100g).

Vitamin	Fresh carrot l eave s
Vitamin B_1	0.15± 0.00
Vitamin B_2	0.37 ±0.00
vitaminB_3	0.16 ±0.07
Ascorbic acid	59.45 ±0.02
Vitamin E	8.04 ±0.01

Table 4: Phytochemical Composition of fresh carrot (*Daucus carota*) leaves (mg/100g).

Phytochemical	Fresh carrot l eave s
Tannin	9± 0.00
Flvonoid	16 ±0.07
Alkaloids	963 ±0.00
Saponin	58 ±0.07
Phenol	17 ±0.19
Sterol	2± 0.00

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