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Comparative Vitamins Content of Pulp, Seed and Rind of Fresh and Dried Watermelon (*Citrullus Lanatus*)

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ABSTRACT

The nutritional quality of pulp, seeds and rind of *Citrullus lanatus*, was evaluated. The study was carried out on both fresh and dried samples. Results of the investigation reveal that *Citrullus lanatus* rind was superior to *Citrullus lanatus* Pulp, seed. *Citrullus lanatus* pulp,seed and rind were low in their pro-vitamin A (carotenoid) though that of the rind was higher compared with other parts of the fruit. More so, vitamin C (ascorbic acid) content of the rind and seed were significantly ($p< 0.05$) lower compared with the pulp. Beside, the fruits generally were low in B vitamins. Although there was a significant difference at ($p< 0.05$) in the nutrient contents in the different parts of the fruits, the nutrients in the seeds and rind which are the parts always discarded, can contribute immensely to recommended daily allowance and maintenance of good nutritional status and hence good health for both man and animals.

Keywords: *Comparative, Vitamins-Content, Pulp, Seed, Rind Watermelon (Citrullus Lanatus).*

1. INTRODUCTION

The optimal diet for everyone as recommended by the world health and food and agriculture organization is a low-fat, and fibre diet rich in complex carbohydrate characterized by a frequent consumption of fruits and vegetables at least 400g daily as well as whole-grains, cereals and legumes at least 30g daily (WHO/FAO,2003). A variety of fruits and vegetables are however consumed in Nigeria on a daily basis, and they form an integral part of our diet but most times only the fleshy pulp of these fruits are consumed leaving the seed and the rind. Fruits contain a high percentage of water averaging 85%, fats and protein in very small varying amounts, a fair proportion of carbohydrate present as cellulose, starch in small quantity and sugar. Beside their low energy value, they are known for their high micronutrients concentrations including carotene or provitamin A, vitamin k, ascorbic acid, riboflavin, iron, iodine and other mineral elements (Shiundu, 2004). The main contribution of fruits in nutrition is vitamins and the main source from which humans and animals derive their vitamin is from fruits and vegetables. Vitamin A in fruits is present as the precursor carotenes (Alpha, Beta and Gamma) which can be converted to the vitamin in the body. Fruits such as pawpaw, oil palm, carrots and pumpkins provide large quantities of carotene. Ngoddy & Ihekeronye (1985) reported a value of 200 IU each for avocado pear and passion fruit. Fruits and vegetables provide vitamin and minerals in quantities high enough to provide the body with its needs (Fraser & Cooper, 2006). They have been linked to the management of anaemia because of their vitamin C content. When consumed with meals, they enhance iron status of the individual their high content of vitamin C improves absorption of iron (Wardlaw & Hamphl, 2007). Seeds and peels of grapes and pomegranates are also rich sources of natural antioxidant (Jayaprakash *et.al*. 2001). Research studies have recently shown that a diet rich in the vitamin antioxidants (Vitamin C and E) and the carotenoids is associated with improved health and a lower risk of coronary heart disease and cancer (Pamplona-roger,2008). Food of vegetable origin rich in fibre, minerals and vitamins, also bring substances to the diet that although,not well understood nor classified as nutrients, display potent anticarcinogenic and curative effects on a variety of diseases and illnesses, these substances are known as phytochemcials (Pamplona-roger,2008).The fibre content of fruits and vegetables has been reported to have beneficial effects on blood

cholesterol and they aid in the prevention of large bowel diseases (IFT,1990 & Jenkins,1978). It has also been reported that populations that consume diet rich in fruits and vegetables have significantly lower rates of many types of cancers (Voorrips *et.al*. 2000). Fruits have high vitamin, mineral, fibre, phytochemcial and antioxidant in their pulps, seeds and rinds but they have not been given much importance in the diets of many Nigerians especially the seed and rind which most times are discarded. Due to ignorance of the nutritive value and their curative advantages, lack of proper storage facilities, poor distribution, rising cost of fruits, poor accessibility and affordability (Tindall & Florence,1983), most low income groups have not given fruit consumption much impotance in their daily diet. Fruits botanically are seed containing organs found in the ripened ovary of a flower. They are the parts of plants that produce seeds. Fruits mostly are fleshy and juicy some may be dried such as cereal, grains, nuts and legume pods. Fruits as reported by Kilgour (1987) form about 4% of the world's food supply. *Ctrullus lanatus* has its origin according to (Pamplona-roger, 2008) in the hot, dry regions around the Mediterranean. Its cultivation has extended to tropical and subtropical regions on the American continent. The *Citrullius lanatus* plant is a herbaceous creeping plant of the botanical family cucurbitaceous, which produces from 3 to 5 fruits weighing from 3 to 10 kilogram; the 'florida giant' may weigh up to 20 kilogram (Pamplona-roger, 2008). *Citrullus lanatus* fruit is round, oval or oblong, with a light green to very dark green skin, variously patterned or stripped and red, yellow or orange flesh. The seeds are flat and smooth, varying in size and may be white tan, brown, black red, green or motted (FAO, 1994). The *Citrullus lanatus* fruit has a smooth exterior rind (green, yellow and sometimes white and a juicy, sweet interior flesh). The rind is used in preserves, jellies and conserves and to make pickles (Dane *et.al*. 2004 and Dane & Liu, 2007). *Citrullus lanatus* can be used for smoothes, sorbets or granite depending on the texture whether smooth or coarse. The rind is also edible and is sometimes used as vegetable (Wada, 1930). In China, they are stir fried, stewed or more often pickled. The deskinned and de-fruited rind is cooked with olive oil, garlic, chilipepper, scallions, sugar and rum. Pickled *Citrullus lanatus* rind is also commonly consumed in the Southern United States (Mandel *et.al*. 2005).The inner rind which is usually light green or white contains many hidden nutrients and is edible, but most times is avoided due to its unappealing flavor. It contains mainly citrulline which is a known stimulator of nitric oxide (Science daily, 2008). *Citrullus lanatus* juice can be made into wine the seeds are consumed as snacks in china, Israel and elsewhere. The pulp is cooked and seeds eaten in Sudan Nigeria and Egypt (Goda, 2007). *Citrullus lanatus* contains a significant amount of citrulline and after consumption of several kilograms an elevated concentration is measured in blood plasma (Mendel *et.al*. 2005). In Africa, seed may be ground into coarse flour or oil may be extracted from them, mature fruit may be prepared and used as summer squash (USDA, 2003). Studies have shown that fruits and vegetables contain among other vital nutrients, an appreciable quantity of vitamin, fibre, antioxidants, phytochemicals and a daily consumption of at least 5 to 10 servings of a wide variety of fruits and vegetable is an appropriate strategy for significantly reducing the risk of chronic diseases and to meet nutrient requirement for optimum health (Liu, 2004). These fruits are consumed, fresh, canned or processed and its consumption results in the production of vast amount of agricultural waste from their seeds and rind. Despite the numerous nutritional benefits from fruits only a small portion of plant material is utilized directly for human consumption (El-Adaway *et.al*.1999), the remainder part may be converted into nutrient for either food or feed or into fertilizer. Although several research work have been done on the nutritional evaluation of some locally available fruits, Obizoba *et.al.* (2004), Akubor & Onimawo (2005), Animawo (2005), Adepoju & Adeniji (2008), Ene-obong (2001), Itam (1983), Essien (1994) and Edet (2004), not much has been done on the nutritional and anti-nutrient contents of many locally available fruits and their pulp, seeds and rind which is most times discarded. The knowledge of the nutritive and the anti-nutrient content of various parts of these fruits will encourage their consumption in diverse ways and re-utilization of the vast amount of seeds and rind discarded as waste for human food, animal feed, fertilizer and possibly in other value added applications.

2. MATERIALS AND METHODS

2.1 Sources of Materials

8kgs of *Citrullus lanatus* was bought from the local markets in Calabar, Obudu and Obubra Local Government Area in Cross River State. The samples were bought when available in their fresh state and in sufficient quantity for the analysis.

3. COLLECTION AND TREATMENT OF SAMPLES

Four *Citrullus lanatus* weighing 2kgs each were used for the vitamins content evaluation.

The fruit were bought at different times for the vitamins analysis. 4kgs of *Citrullus lanatus* prepared and dried using a hot air circulating oven (Gallenkamp hot box size one) at 50^{o}c and stored in a labeled air tight containers in a refrigerator. The same quantity was bought and used as fresh samples for the vitamins evaluation. The samples for drying were washed and cut open with a knife into small piece. *Citrullus lanatus* seeds were removed from the pulp before separating the red pulp from the rind. The seeds were washed, allowed to drain and placed on a foil. The pulp was chopped into shreds, allowed to drain and placed in another tray lined with foil, the rind was chopped into

tiny cubes and placed in a separate tray line with foil, there were transferred into the oven.

4. DETERMINATION OF VITAMINS CONTENT

The vitamins in the fresh and dried samples were determined using the methods of association of vitamin chemists (A O V C 1966) vitamin A and B were determined using the spectrophotometer method described by Kirk and Sawyer, (1991) at 325nm. Vitamin B (Niacin, thiamin and Riboflavin) was determined using a flame photometer while viyamin C was estimated by the 24 dinitrophenol hydrazine methods as described in (A O A C 1966).

5. ANALYSIS OF DATA

The results of the proximate analysis and anti-nutrient screening were analysed for statistical significance by one way ANOVA (F- ratio) (Welkowitz, 1976) and student 't' test were applicable values at ($p<0.05$) were regarded as significant in comparison with appropriate control. All data were expressed as means of ± SEM.

6. RESULT

The results of assessment of vitamins content of fresh and dried *Citrullus lanatus* presented in (table 1) based on mg/100g fresh and dried matter.

Statistical evaluation reveals that pro-vitamin A, Niacin and vitamin C content while those of thiamin and riboflavin contents of fresh and dried *Citrullus lanatus* pulp, seed and rind.

From the table 1, the pro-vitamin A content of fresh *Citrullus lanatus* pulp (15.73 ± 0.17) was significantly lower than of the rind (76.91 ± 0.01) at ($P>0.05$). The dry pulp also revealed that the pulp (57.25 ± 0.42) was significantly lower than the rind (169.58 ± 0.17) at ($P>0.05$). The seeds of *Citrullus lanatus* in both the fresh and dried samples recorded no value hence, pro-vitamin A was not present. Statistical, analysis of thiamine content of fresh *Citrullus lanatus* as seen in the table reveals that the seed (0.13 ± 0.00) and rind (0.14±0.00) when compared with the pulp (0.09 ± 0.00) were significantly higher than the pulp at ($P<0.05$). The dry seed (0.11 ± 0.01) and rind (0.13 ± 0.01) were significantly higher than the pulp (0.06 ± 0.00) at ($P<0.05$). There was no significant difference between the rind and seed in both fresh and dry samples. More so, Riboflavin content of fresh *Citrullus lanatus* seed (0.13 ± 0.02) was significantly higher than the pulp (0.03 ± 0.00) at ($P<0.05$). Dry *Citrullus lanatus* seed (0.11 ± 0.01) was also significantly higher than the pulp (0.02 ± 0.00) at ($P<0.05$). Riboflavin was not detected in the rind of both fresh and dried *Citrullus lanatus.*). However, the Niacin content of fresh *Citrullus lanatus* rind (0.06 ± 0.01) when compared with the pulp (0.02 ± 0.00) was significantly ($P<0.05$) higher than the pulp but significantly lower than the seed (3.22 ± 0.00). The seed however was significantly higher than the pulp. The dry seed (2.97 ± 0.01) of *Citrullus lanatus* was significantly higher than the pulp (0.01 ± 0.00) and rind (0.05 ± 0.00) at ($P<0.05$). The rind was however significantly higher than the pulp. Values for the pulp and rind were negligible. Beside, result shows that the ascorbic acid content of fresh *Citrullus lanatus* rind (7.63 ± 0.59) was significantly ($P<0.05$) lower than that of the pulp (9.39 ± 0.59) but higher than the seed (5.35 ± 0.00). Similarly, the dry seed (2.35 ± 0.59) showed a significantly lower value than the pulp (4.11 ± 0.59) and rind (2.93 ± 0.59) at ($P>0.05$) but the pulp was significantly higher than the rind at ($P<0.05$).

7. DISCUSSION

The fresh and dried pulp, seeds and rind of *Citrullus lanatus* were analysed and interpreted. The results of minerals and vitamin content of fresh and dry *Citrullus lanatus* seeds was closely comparable to that of Pamplona (2008) and USDA (2003) who worked on the nutrient contents of fruits. The values obtained for pro-vitamin A content in fresh *Citrullus lanatus* pulp (15.73µg) and *Cucurbita pepo'L* pulp(121µg) was lower than the findings of Pamplona (37.0µg) for *Citrullus* and (160µg) for *Cucurbita*, USDA (366iu). PSro-vitamin A was not detected in the seeds as observed in the study (0µg). The flesh of Citrullus lanatus is an important source of carotenoid, lycopene and beta-carotene (pro-vitamin A) as reported by Setiawan *et.al*. (2001) but the pro-vitamin A content in this study was low in the pulp of *Citrullus lanatus*. Except for pro-vitamin A, the B vitamins and ascorbic acid were lower in the dry sample than the fresh samples this might be as a result of the volatile characteristics of these vitamins. The B and C vitamin are known to be water soluble and heat labile which may be the reason for their reduction, carotene generally are unaffected by most processing methods, as reported by Vieth (1979) the loss of fat soluble vitamin during cooking is usually lower than their water soluble counterpart, this could also be the reason for the increased pro vitamin A content in the dry and more concentrated sample. According to Anderson (1966) fruits when fresh provides vitamin C which is essential for strong blood vessels and healthy gums, but results from this study has shown that dry fruits also contain an appreciable amount of vitamins as in fresh fruits, which agrees with Pamplona (2008) who stated that fresh ripe fruits evidently provides the greatest level of vitamin, flavonoids and antioxidants but if not available, it is always better to eat fruits that has been preserved by some methods than not to eat it at all. Pro-vitamin A content was significantly high in the rind of *Citrullus lanatus* compared with the pulp, the seeds of *Citrullus lanatus* were significantly higher than the pulp and rind in its Niacin content, the B vitamin contents in

other part of the fruit was negligible. Ascorbic acid was significantly high in the pulp and rind of *Citrullus lanatus* compared with the seed.

TABLE 1. Vitamin contents of fresh and dried watermelon (*Citrullus lanatus*)

	Carotene (µg/100g)	Thiamine (mg/100g)	Riboflavin (mg/100g)	Niacin (mg/100g)	Ascorbic Acid (mg/100g)
FWMP	15.73 ±0.17	0.09 ±0.00	0.03 ±0.00	0.02 ±0.00	9.39 ±0.59
FWMS	0.00 ±0.00	0.13 ±0.00*	0.13 ±0.02*	3.22 ±0.00*	5.28 ±0.00*
FWMR	76.91 ±0.01*	0.14 ±0.00*	0.00 ±0.00	0.06 ±0.01*,a	7.63 ±0.59*,a
DWMP	57.25 ±0.42	0.06 ±0.00	0.02 ±0.00	0.01 ±0.00	4.11 ±0.59
DWMS	0.00 ±0.00	0.11 ±0.01*	0.12 ±0.00*	2.97 ±0.01*	2.35 ±0.59*
DWMR	169.58 ±0.17*	0.13 ±0.01*	0.00 ±0.00	0.05 ±0.00*,a	2.93 ±0.59*,a

FWMP = fresh water melon pulp; DWMP = dry water melon pulp;
FWMS = fresh water melon seed; DWMS = dry water melon seed;
FWMR = fresh water melon rind; DWMR = dry water melon rind.
Values are expressed as mean ± SEM, n = 3.
*p<0.05 vs pulp; a = p<0.05 vs seed.

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