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Trace Metal Distribution and Nutritional Values of Some Varieties of Water Melon in Ogun State Nigeria

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ABSTRACT

The trace metal distribution and the nutritional values of some tropical varieties of watermelon found in local markets in Ogun State Nigeria; Citrullus Vulgaris. Var. Lanatus, Citrullus Lanatus Var. Citroides and Citrullus Vulgaris Var. Lanatus has been investigated and results has shown that the three varieties have nearly same percentage water content on their fleshy fruit part; Citrullus V. Var. Lanatus – 91.45 %, Citrullus L.Var. Citroides – 91.50 % and Citrullus V. Var. Lanatus – 91.35 %. Accordingly the water content of the seeds were also close; 5.15 %, 5.15 % and 5.10%. The bulk of the proteins were in the seeds; 28.10 g, 28.10 g and 28.20 g whereas the flesh indicated low values; 0.60 g, 0.59 g and 0.61 g. Also the bulk of the lipids reside in the seeds; 46.2 g/kg, 46.20 g/kg and 47.25 g/kg whereas the flesh indicated low values; 0.42 g/kg, 0.41 g/kg and 0.39 g/kg respectively. The carbohydrate content indicated high values in the seeds; 15.21 g/kg, 15.21 g/kg and 15.28 g/kg. The values indicated by the flesh were significant; 7.18 g/kg, 7.05 g/kg and 7.11 g/kg. Ascorbic acid was only present in the flesh. The trace metals like calcium, iron, magnesium, potassium, sodium, zinc, copper and manganese were found in varying amounts but selenium was only found in the flesh and not in the seed.

Keywords: Watermelon, Carbohydrate, Lipid, Protein, Trace Metals, Curcurbitaceae

I. INTRODUCTION

Curcurbitaceae is a large family which includes many economic species such as melon, watermelon, various gourdes, pumpkins and cucumber which are of particular importance to the inhabitants of sub-Sahara Africa (IPGRI, 2002). Cucumber (Cucumis salivas L) has its origin as India, melon (Cucumis melo L) and water melon (Citrullus lanatus) in Africa whereas squash pumpkin and gourdes (Curcurbita species) has their origin as America. Thus, cucumber, melon and water melon are relatively recent introduction to the new world. Most domesticated species of curcurbitae were introduced from Mexico, Central America and South America with the migration of Native Americans. (McCreight, 1998). Many curcurbitaceae species are eaten in several different forms as seeds, leaves, fruits and sometimes as flowers by villagers throughout Africa. (IPGRI, 2002). In most countries, melon seeds are eaten as snacks while in other places, it is either prepared as whole toasted seed or fried into a cake usually prepared from the milled seeds (Odunfu, 1981; Ikereogu, 1984; Okigbo, 1984).

They belong to the family of the cucurbitaceae, and are widely cultivated for their seeds, which have high content of fat and protein (Ng, 1993; Itam, 2006). In some places too, the seeds are used greatly in West African cookery, (Anhwange *et al.,* 2010) where they are obtained either in shelled or unshelled conditions in most southern markets.

The immense nutritional advantage of watermelon lies in the significant content of Citrulline. Citrulline,

a product of the catabolism of arginine in the endothelial cells is present in different varieties of water melon and is highly concentrated in the rind than any other part of the fruit.

Citrulline plays an important role in the body's urea cycle which removes nitrogen from the blood and helps to convert urea, which is then excreted in the urine. Disorders in the urea cycle can lead to a lethal building up of nitrogenous compounds such as ammonia in the blood streams. This is where Citrulline help to create arginine: an important amino acid involved in the urea cycle of which some individuals produce too little of. Arginine boosts nitric oxide which relaxes blood vessels and then helps treat "angina" and other cardiovascular disorders. It also play a major role in the blood circulation problems associated with sickle cell anaemia and has been credited with boosting muscular growth, stimulating the immune system, improving wound healing, curing impotence and more.(Rimando and Perkins-vaezie, 2005). Citrulline may also function as a natural alternative to Viagra. Both Citrulline and Viagra increase blood flow to pelvic regions and across spongy tissues. Citrulline does so by increasing the body's release of nitric oxide while Viagra does so by destroying those enzymes that inhibit nitric oxide's effects. Watermelon is also loaded with lycopene, a powerful antioxidant which is widely recognized as a protective against prostate cancer as well as a significant agent in the enhancement of male fertility (Leskover, Bang, Crosby, Maness, Francu and Perkins-vaezie, 2004). Watermelon seeds are good sources of trace metals like zinc, copper, iron, manganese, calcium and even sodium. Recent studies also interestingly reveal that despite the presence of oxalates and phytates contained in the seeds, the iron and zinc present in watermelon is surprisingly bioavailable up to the tone of between 85-90%. These oxalates and phytates can sometimes bind with minerals like zinc and iron so as to reduce their bioavailability. Selenium is known to be present in the fleshy part but not in the seed. Although several research work have been done on the nutritional evaluation of some locally available fruits, (Obizoba, Vellon, Colomer and Lupu 2005;. Adepoju and Adeniji 2008; Ene-obong 2001; Essien (1994); AOAC 1991). Not much has been done on the nutritional and anti-nutrient contents of many locally available fruits: their pulp, seeds and rind which are most times discarded. Information regarding 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 peels which often are discarded as waste for human food, animal feed and fertilizer (Johnson, Iwang, Hemen, Odey, Efiong and Eteng, 2012)

II. EXPERIMENTAL

Sample preparation

Fresh samples of the three varieties of watermelon citrullus vulgaris var lanatus, citrullus lanatus var citroides and citrullus vulgaris var citroides were washed with normal saline and allowed to dry in an airy corner of the laboratory. The rind was carefully peeled off with a sharp knife. The seeds were carefully picked while the fleshy edible part was thawed with a juice extractor. The extracted juice was then filtered with muslin cloth and later centrifuged at 600 rpm and the supernatant stored for analysis. The seeds were then dried to constant weight in an oven at $60^{o}C$ for 24 hours to remove moisture content and then ground using mechanical grinder, put in air tight container and stored in a desiccators for further analysis. Similar procedure has been reported by (Ekpa, 1989). Digested was carried out using a 1:2 HCl and HOCl using the Kjeldahl distillation apparatus, filtered and stored for analysis.

Sample Analysis

The carbohydrate content of the various samples of watermelon prepared for study was determined using the Anthrone Method. In the method, carbohydrates are dehydrated by concentrated H_2SO_4 to form furfural while furfural itself condenses with Anthrone

reagent to form a blue coloured complex which is measured spectrophotometrically at 629nm using UV-2401 PC by SHIMADZU CORP. The ascorbic acid content was determined using the 2, 4-Dinitrophenylhydrazine (DNPH) Method in which the ascorbic acid present in the watermelon samples is oxidized to dehydro-5-ascorbic acid. The dehydro-5-ascorbic acid then couple with the 2, 4-Dinitrophenylhydrazine to form oxazone. By treating the oxazone formed with 85% H_2SO_4, causes the rearrangement which yields a red coloured complex. Thiourea added to the 2, 4-Dinitrophenylhydrazine prevents the oxidation of the 2, 4-Dinitrophenylhydrazine by interfering substances. The red coloured complex so formed was measured spectrophotometrically at 520 nm using the UV-2401 PC.

The moisture content of the samples was determined by heating a unit quantity of sample to dryness in an oven to a constant weight. The total lipid content was determined colorimetrically by E van Handel's Method; a colorimetric method mainly used to estimate lipid content in very small samples (some mg) or in small aliquots of large samples. In this method, a micro-colorimetric assay is developed for a single mosquito, and should be reliable for other small tissue samples (*E. Van Handel, J Am Mosq Control Assoc 1985, 1, 302*). In the method, a pink colour is allowed to develop for five minutes and read at 490nm. The Biuret method was adopted for the protein determination based on the principle that the -CO-NH- group of proteins form o purple complex with copper ions in an alkaline medium and all proteins contain the peptide bond. The method is fairly specific and there is little or no interference from other compounds. Some substances like urea and biuret interfere because they possess the -CO-NH- group. Trace metals in the samples were determined using Atomic Absorption Spectrophotometry; THERMOSCIENTIFIC iCE ™ 3000 SERIES with dedicated flame and furnace

Results

Analysis of trace metals and nutritional values of locally sourced tropical varieties watermelon was carried out using the spectrophotometric method for the trace metals, biuret method for protein, Anthrone method for carbohydrate etc. and the following results were obtained.

Nutritional Values of Different Varieties of Water Melon

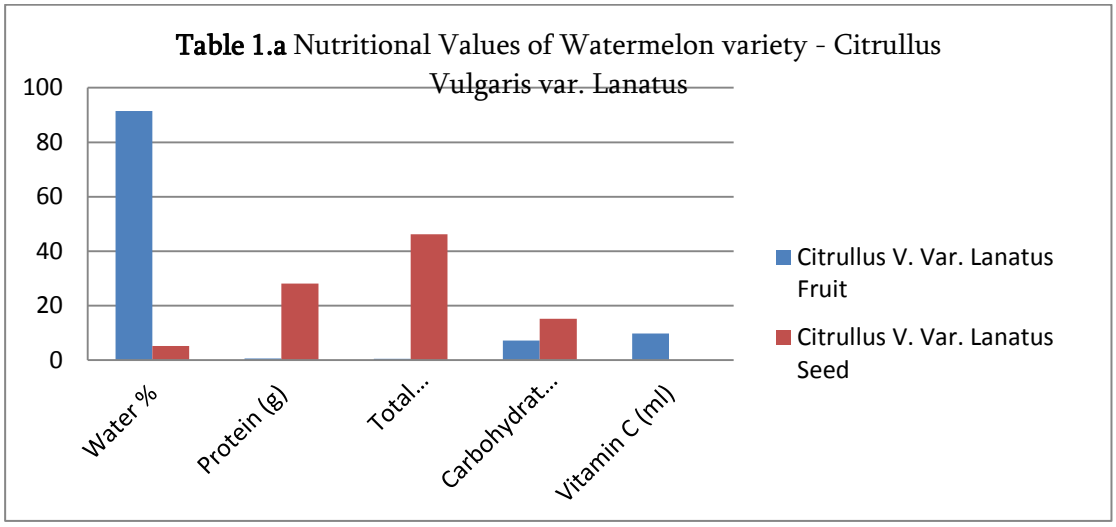
Table 1. Nutritional Values of Watermelon varieties

Parameters	Citrullus V. Var. Lanatus		Citrullus L.Var. Citroides		Citrullus V. Var. Citroides	
	Fruit	Seed	Fruit	Seed	Fruit	Seed
Water %	91.45	5.15	91.50	5.15	91.35	5.10
Protein (g/kg)	0.60	28.10	0.59	28.10	0.61	28.20
Total lipids(g/kg)	0.42	46.20	0.41	46.20	0.39	47.25
Carbohydrate(g/kg)	7.18	15.21	7.05	15.21	7.11	15.28
Vitamin C (ml)	9.80	Nil	9.48	nil	9.54	nil

Trace Metal Content of Varieties of Water Melon

Table 2. Trace metal distribution in Watermelon varieties

Parameters	Citrullus V. Var. Lanatus		Citrullus L.Var. Citroides		Citrullus V. Var. Citroides	
	Fruit	Seed	Fruit	Seed	Fruit	Seed
Calcium (mg)	8.00	53.00	7.80	52.00	8.20	53.00
Iron (mg)	0.16	7.20	0.15	7.18	0.15	7.22
Magnesium(mg)	10.00	5.20	10.50	5.30	10.80	5.40
Potassium (mg)	114.00	628.00	112.00	640.00	113.00	642.00
Sodium (mg)	2.00	95.00	1.80	95.50	1.90	95.55
Zinc (mg)	0.06	10.14	0.05	10.08	0.05	10.06
Copper (mg)	0.03	0.68	0.02	0.63	0.02	0.62
Manganese (mg)	0.03	1.55	0.02	1.53	0.03	1.52
Selenium (µg)	0.10	nil	0.09	nil	0.08	nil



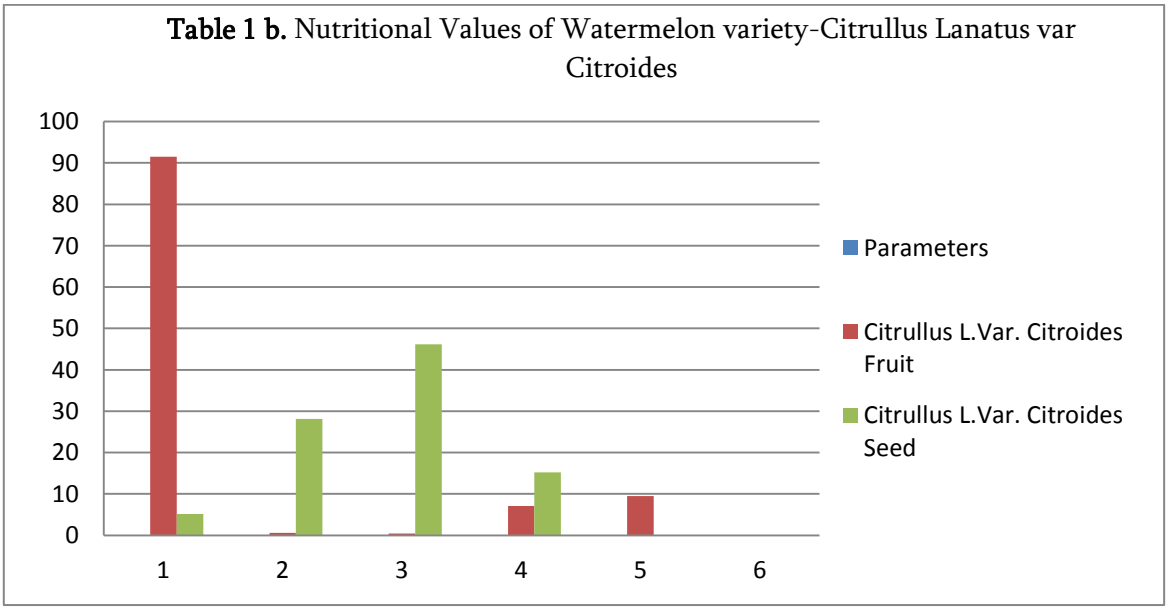


Table 1.c Nutritional Values of Watermelon variety - Citrullus Vulgaris var Citroides

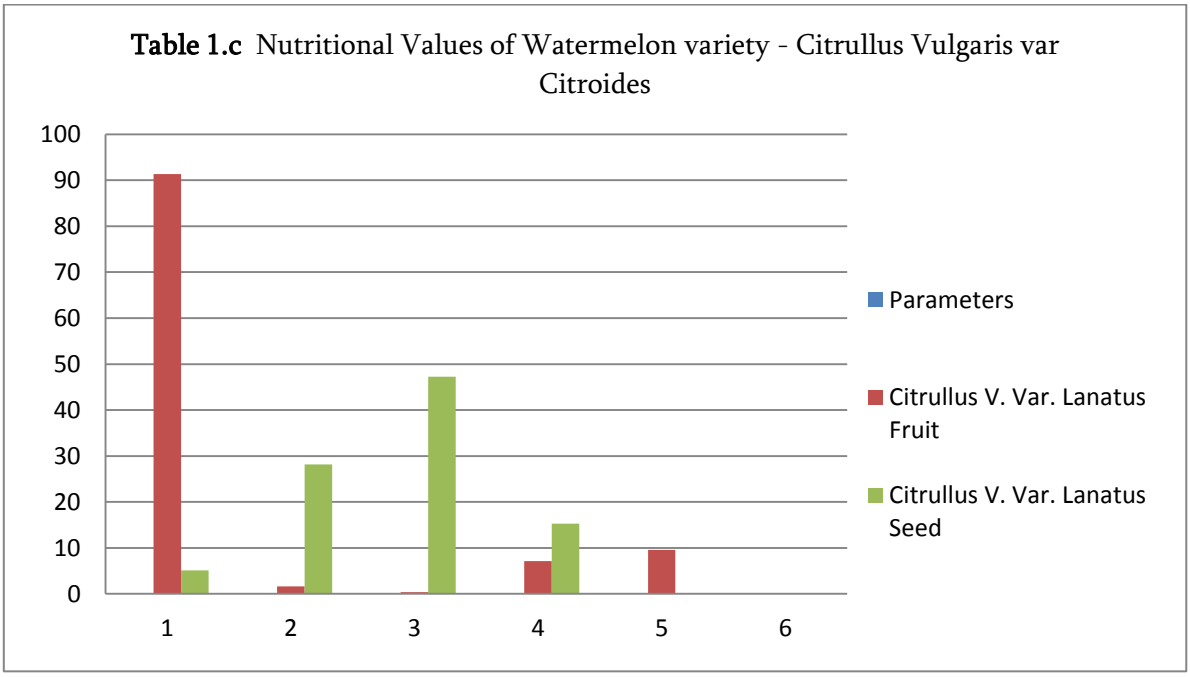


Table 2.a Trace metal distribution inWatermelon variety - Citrullus Vulgaris var. Lanatus

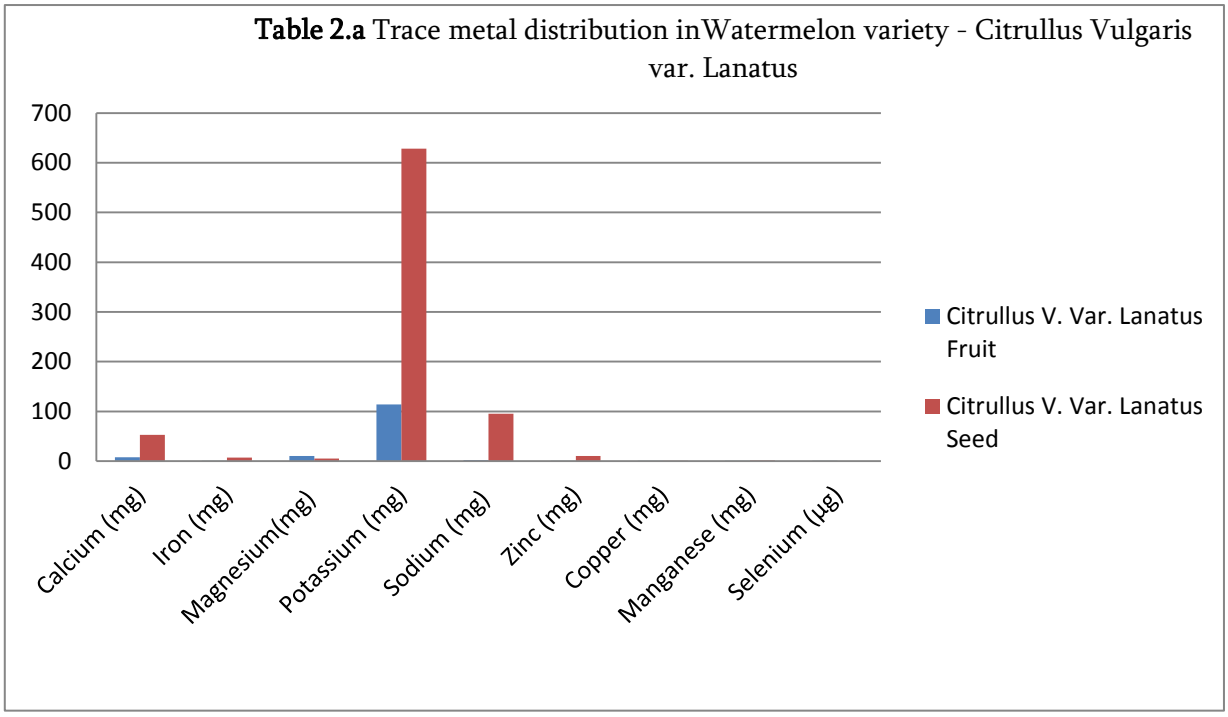


Table 2.b Trace metal distribution inWatermelon variety - Citrullus Lanatus var. Citroides

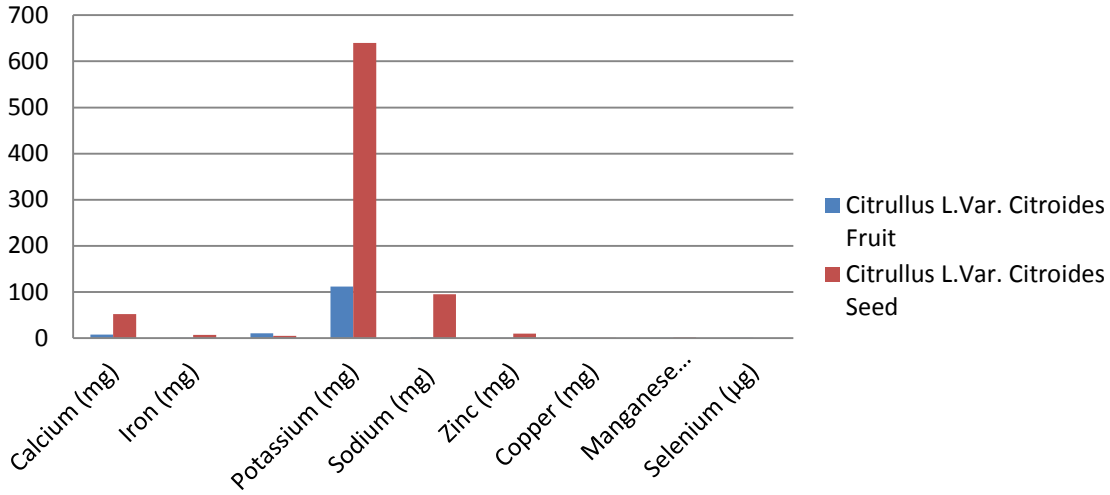
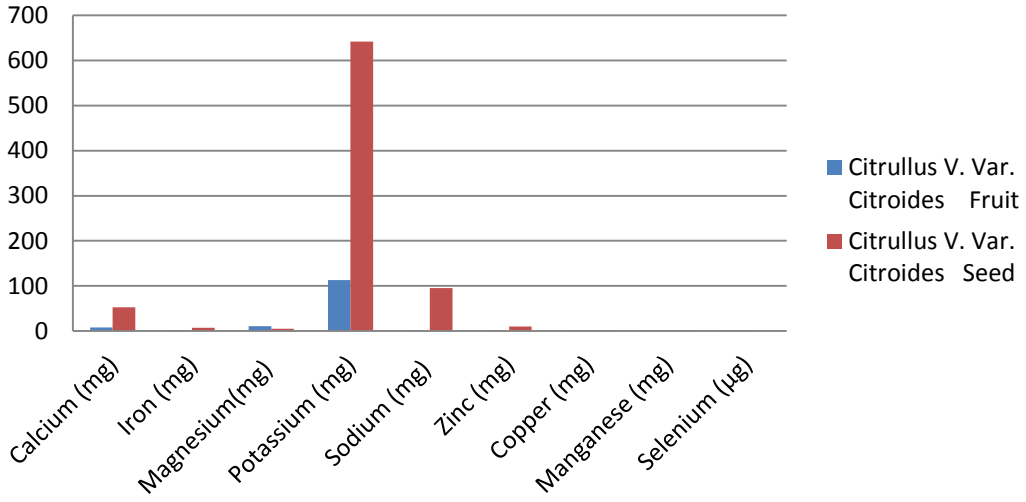


Table 2.c Trace metal distribution inWatermelon variety - Citrullus Vulgaris var. Citroides



III. DISCUSSION

The results obtained showed that for each variety of watermelon, over 90 % of the weight of the flesh consists of water whereas the seeds contain as little as 5 %. The concentration of protein was in the seeds with very little (below 1.0 g/kg) in the flesh. The lipids were mainly found in the seeds as much as 46.20 g/kg in others except for Citrullus V. Var. Citroides where the value was higher 47.25 g/kg. The carbohydrate content was seen to be much higher (nearly double) in the seeds than in the flesh and again higher in Citrullus V. Var. Citroides 15.28 g/kg. There was no significant difference in the other two varieties. The vitamin C content was highest in Citrullus V. Var. Lanatus 9.80 ml. However, vitamin C was absent in the seeds. Trace metal analysis showed that potassium was very high in all the varieties, both in the seeds and the flesh. This was followed by magnesium and closely by calcium. Apart from Selenium which was not present in the seeds, all the trace metals were predominant in the seeds as compared to the flesh. Iron was found in a significant amount in the seeds as high as 7.22 mg in Citrullus V. Var. Citroides while Citrullus V. Var. Lanatus and Citrullus L.Var. Citroides gave 7.20 mg and 7.18mg respectively.

IV. CONCLUSION

The entire result of the trace metal analysis has revealed the extent of the require trace metals that are available in all the samples monitored. It a common practice however that people consume watermelon flesh and throw away the seeds especially in local environments. The essence of this work is to determine to what extent the nutrients in watermelon are maximally consumed. Since most of the required trace metals are bound in the seeds of all the varieties of watermelon studied, it means that what is thrown away is more than what is consumed. The seeds are not in any way toxic and so should not be thrown away. Copper and Zinc are great enzyme co-factors and are required in the body to a reasonable extent. A combination of the flesh and seed could afford to a good extent the daily requirement of minerals in the human body.

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