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A COMPARATIVE STUDY ON THE MICRONUTRIENTS COMPOSITION OF WATERMELON SEED AND WILD MELON SEED (EGUSI)

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Abstract: Melon seed is highly nutritious, and it is commonly consumed in Nigeria as soup, whereas watermelon seeds do not treat equally as the wild melon. Wild melon and watermelon are from the same family of Cucurbitaceae with sweet edible, fleshy fruit. The name *melon* coin from Latin melopepo (Wehner 2008). These melons are the essential types of melons (watermelon and wild melon). Seeds found most familiar in Nigeria were evaluated for their proximate and micronutrient composition. The fruits were purchase from Oje market Ede, Osun State. The fruit was allowed to rust, and the seeds were removed, washed, and dried under the sun. The dried seeds were dehulled, milled, and stored in the desiccator for further analysis. Samples were analyzed chemically according to the official methods of analysis described by the Association of Official Analytical Chemists (A.O.A.C., 18TH EDITION, 2005) for Proximate (Crude protein, Crude fat, Crude fiber, Carbohydrate, and moisture content). Selected minerals are also analyzed. Result reveals that seeds of the samples were all rich in protein, fat, energy, and some minerals. We discovered that high concentrations of Crude protein and minerals comparable value in watermelon seeds are more than melon seeds content; therefore, we suggest that individuals eat the seeds alongside the fruits liable to bioavailability of these nutrients apart from the nutrients in the fruit. We concluded that watermelon seed is an essential source of minerals, protein, and energy. So, the study recommends that the seed should be chewed with the flesh and not thrown away.

Keywords: Watermelon, Wild-melon, Micronutrients, Seeds, Composition

1.0 Introduction

One of the ways developing countries like Nigeria can overcome food security challenges considering the growing population is the exploitation of underutilized plants and animal foods, as reported by Ayoola and Adeyeye (2020). Nutrients from animal sources are costly compared with plant sources of a nutrient. One of the underutilized seeds is the watermelon (C. lanatus) seed. Majorly watermelon is the consumption of its succulent, crisp, refreshing pulp as a dessert. While in Nigeria, watermelon pulp is mainly consumed, the seeds are usually thrown away as waste. Whereas the 'waste material' could pose ecological problems related to the proliferation of insects and rodents. While seeds of C. lanatus (watermelon are discarded, that of C. colocynthis (egusi melon) utilizes widely cultivated for seeds, the seeds are processed as condiments and thickeners in local Nigerian soups. The rind of C. colocynthis (egusi melon), bitter and not edible (Ayoola et al., 2018; Anthony *et al.*, 2018).

1.1 **Egusi seed** (wild melon), similar in look to the watermelon. Wild melon flesh is inedible, but the seeds are a valuable food source in Africa (Dane *et al.*, 2016). Other species with the same culinary role and are also called egusi include *Cucumeropsis mannii* and *Lagenaria siceraria*. (Dane *et al.*, 2016).

1.2 **Watermelon**, if from the Cucurbitaceae family (*Citrullus lanatus* var. *lanatus*, is a vine-like (scrambler and trailer) flowering plant domesticated from southern Africa. Huge, sprawling annual plant, hairy pinnately-

lobed leaves with yellow flowers (Evans and Lynette 2015). It is grown for fruit, also known as a *watermelon.* The fruit is green with dark green stripes or yellow spots, and it is sweet and very juicy.

1.3 Significance of the Study

The melon fruits are found in abundance in Africa, and as such, they are significantly cheap compared to other significant consumables in the market. The availability of these fruits is an essential criterion as the seeds, if found to be significantly nutritive, will serve as a critical tool to fight malnutrition by respective organizations. The relatively low price of these fruits and the ease at which the seeds are gotten from the fruits is of great importance if the seeds are greatly nutritive.

1.4 Scope and Limitation of the Study

Various types of melon make up the melon family, and the research work is only limited to the watermelon type and the wild melon type. The scope of the study only entails the seeds of these varieties of melon are watermelon and wild melon.

2.0 Materials and Methods

The watermelon and egusi fruits were purchased from Oje market Ede Osun State, Nigeria. Were washed correctly and cut into a clean jute sack where it was allowed to ferment for 72hours. The seed was pick from rotten and decaying fruit. The resulting kernels were dried in an air oven to a constant weight. The dried grains were milled wearing a blender (National model MX-795N, Matsushita, Malaysia) into fine powder. The samples were analyzed on the micronutrient's composition of the piece. Minerals were determined using atomic absorption spectrophotometer after the wet digestion process. All determinations were carried in triplicate

2.1 METHODS OF ANALYSIS WITH REFERENCE NUMBER

Samples were analyzed chemically according to the official methods of analysis described by the Association of Official Analytical Chemists (A.O.A.C., 18TH EDITION, 2005). All analysis was carried out in duplicate.

2.2 Crude protein determination (AOAC official method 988.05)

The crude protein in the sample were determined by the routine semi-micro Kjeldahl, procedure/technique. This consists of three techniques of analysis namely Digestion, Distillation and Titration.
Apparatus**:** Analytical Balance, Digestion tubes, Digestion Block Heaters, 50ml Burette, 5ml Pipette, 10ml Pipette, 10ml Measuring Cylinder, 100ml Beakers, Fume Cupboard.
Reagents**:** ConC.H_2SO_4, 0.01NHCL, 40% (W/V) NaOH, 2% Boric Acid Solution, Methyl Red – Bromocresol green mixed indicator, Kjeldahl Catalyst tablet.

Digestion

0.5g of each finely ground dried sample was weighed carefully into the Kjeldahl digestion tubes to ensure that all sample materials got to the bottom of the tubes. To this were added 1 Kjeldahl catalyst tablet and 10ml of ConC. H_2SO_4. These were set in the appropriate hole of the Digestion Block Heaters in a fume cupboard. The digestion was left on for 4 hours, after which a clear colourless solution was left in the tube. The digest was cooled and carefully transferred into 100ml volumetric flask, thoroughly rinsing the digestion tube with distilled water and the flask was made up to mark with distilled water.

Distillation

The distillation was done with Markham Distillation Apparatus which allows volatile substances such as ammonia to be steam distilled with complete collection of the distillate. The apparatus was steamed out for about ten minutes. The steam generator is then removed from the heat source to all the developing vacuum to remove condensed water. The steam generator is then placed on the heat source (i.e. heating mantle) and each component of the apparatus was fixed up appropriately.

Determination: 5ml portion of the digest above was pipetted into the body of the apparatus via the small funnel aperture. To this was added 5ml of 40% (W/V) NaOH through the same opening with the 5ml pipette.
The mixture was steam-distilled for 2 minutes into a 50ml conical flask containing 10ml of 2% Boric Acid plus mixed indicator solution placed at the receiving tip of the condenser. The Boric Acid plus indicator solution changes colour from red to green showing that all the ammonia liberated have been trapped.

Titration

The green colour solution obtained was then titrated against 0.01N HCL contained in a 50ml Burette. At the end point or equivalent point, the green colour turns to wine colour which indicates that all the Nitrogen trapped as Ammonium Borate [$(NH_4)_2BO_3$] have been removed as Ammonium chloride (NH_4CL).
The percentage nitrogen in this analysis was calculated using the formula:
% N = Titre value x Atomic mass of Nitrogen x Normality of HCL used x 4
or % N = Titre value x Normality/Molarity of HCL used x Atomic mass of N x Volume of flask containing the digest x 100.
Weight of sample digested in milligram x Vol. of digest for steam distillation. The crude protein content is determined by multiplying percentage Nitrogen by a constant factor of 6.25 i.e. % CP = % N x 6.25.

2.3 Determination of mineral element (AOAC, 975.11)

Calcium, Potassium and Sodium
Apparatus: Heating mantle, Crucible, Glass rod, Flame photometer, 100ml Volumetric flask, Whatman No. 1 Filter paper, Wash bottle, 10ml pipette, funnel.
Reagents: 2 MHCL.
Determination: The ash of each sample obtained was digested by adding 5ml of 2 MHCL to the ash in the crucible and heat to dryness on a heating mantle. 5ml of 2 MHCL was added again, heat to boil, and filtered through a Whatman No. 1 filter paper into a 100ml volumetric flask. The filterate was made up to mark with distilled water stoppered and made ready for reading of concentration of Calcium, Potassium and Sodium on the Jenway Digital Flame Photometer(PFP7 Model) using the filter corresponding to each mineral element.
The concentration of each of the element was calculated using the formula:

$$\%Ca \text{ or } \%K \text{ or } \%Na = \frac{\text{Meter Reading(MR)} \times \text{Slope} \times \text{Dilution factor}}{1000}$$

NB: MR x slope x dilution factor will give you the concentration in part per million(ppm or mg/kg).You get concentration in % when you divide by 10000.

Phosphorus determination (Spectrophotometric method)(AOAC, 975.16)
Phosphorus was determined routinely by the vanado-molybdate colorimetric or spectrophotometric method.

Apparatus: Spectrophotometer or colorimeter, 50ml volumetric flask, 10ml pipette, filter paper, funnel, wash bottle, glass rod, heating mantle, crucibles.

Reagents: Vanadate – Molybdate yellow solution, 2 MHCL.

Determination: The ash of each sample obtained was treated 2 MHCL solution as described for calcium determination above. 10ml of the filterate solution was pipetted into 50ml standard flask and 10ml of vanadate yellow solution was added and the flask was made up to mark with distilled water, stoppered and left for 10 minutes for full yellow development. The concentration of phosphorus was obtained by taking the optical density (OD) or absorbance of the solution on a Spectronic 20 spectrophotometer or colorimeter at a wavelength of 470nm.
The percentage phosphorus was calculated from using the formula:

$$\%\text{Phosphorus} = \frac{\text{Absorbance} \times \text{Slope} \times \text{Dilution factor}}{10000}$$

2.4 Determination of Se, Mg, Pb, Cd, Cu, Mn, Fe, Ni, Zn using BUCK 200 AAS (AOAC, 975.23)
The digest of the ash of each sample above as obtained in calcium and potassium determination was washed into 100ml volumetric flask with deionised or distilled water and made up to mark.This diluent was aspirated into the Buck 200 Atomic Absorption Spectrophotometer(AAS) through the suction tube. Each of the trace

mineral elements was read at their respective wavelengths with their respective hollow cathode lamps using appropriate fuel and oxidant combination

3.0 Statistical Analysis

Data gotten were subjected to simple statistical tools of analysis using Mean, standard deviation, and percentage to confirm the significance of the variables obtained as described by stroud & Booth (2001). Data were subjected to ANOVA to determine the levels of significant difference by performing a multiple comparison post hoc test (Tukey's HSD test). The data were considered significant at $P \leq 0.05$.

4.0 RESULT AND DISCUSSION

Sample, USWM is unshelled water melon seed, sample SWM is shelled water melon seed, sample SM is wild melon seed, sample USM is unshelled wild melon

Table 1.1 Proximate Analysis composition of watermelon and wild melon

	Crude Protein	Crude Fat	Crude Fibre	Ash	Moisture	CHO
SWM	16.61±004	3.65±0.01	5.52±0.01	7.42±0.01	15.60± 0.00	17.15±0.00
USWM	28.83±0.04	19.94±0.01	12.52±0.01	10.2±0.01	4.54±0.02	24.15±0.00
SM	31.32±0.04	44.91±0.03	6.23±0.01	2.94±0.02	4.34±0.53	9.90±0.02
USM	35.01±0.01	36.91±0.00	9.9±0.01	3.95±0.2	2.12±0.00	12.11±0.03

It was observed that the result for table 1.1 shows that value of crude protein ranges from 16.61 ± 0.04, to 35.01 ± 0.04, for all the samples, sample USM has the highest while SWM has the lowest. For crude fat, sample SM has the highest value compare to others. For crude fibre, the value is 12.52 ±0.01, 3.86 ±0.02, 6.23 ± 0.01and 9.9 ± 0.01 for sample SWM, USWM, SM and USM respectively. For moisture, 15.60 ± 0.02, 4.54 ± 0.02, 4.34 ± 0.53 2.12±0.00 for all the samples. For carbohydrate, the value is 24.15 ± 0.06, 17.53 ± 0.00, 12.11±0.03 and 9.90 ± 0.02 respectively.

Table 1.2 Vitamins composition of watermelon and wild melon

	VIT A	VIT B1	VIT B2	VIT B3	VIT B6	VIT C
SWM	146.40± 0.02	0.36± 0.01	0.15± 0.01	2.80± 0.10	3.60± 0.10	1.12± 0.01
USWM	203.79± 0.01	0.67± 0.01	0.22± 0.01	3.96± 0.15	5.36± 0.15	0.64± 0.01
SM	210.70± 0.03	0.76± 0.01	0.27± 0.01	4.56± 0.11	6.60± 0.20	0.76± 0.01
USM	212.01±0.01	0.91±0.00	0.9±0.01	3.95±0.2	5.12±0.00	1.11±0.03

It was observed that the result for vitamin A is 146.40 ± 0.02, 203.79 ± 0.01, 210.70 ± 0.03 and 212.01±0.01 for sample SWM, USWM, SM and, USM respectively. For Vitamin B1 the value is 0.36 ± 0.01, 0.67 ± 0.01, 0.76 ± 0.01, and 0.9± 0.00. For Vitamin B2 the value is 0.15 ± 0.10, 0.22 ± 0.01, 0.27 ± 0.01 and 0.9 ± 0.01 for sample SWM, USWM, SM and, USM respectively. For vitamin B3 the value is 2.80 ± 0.10, 3.96 ± 0.15, 4.56 ± 0.11, and 3.95 ±0.2 for sample SWM, USWM, SM and, USM respectively. For vitamin B6 3.60

± 0.10, 5.36 ± 0.15, 6.60 ± 0.20, for sample SWM, USWM, SM and, USM respectively. For vitamin C the value is 1.12 ± 0.01, 0.64 ± 0.01, 0.76 ± 0.01, for sample SWM, USWM, SM and, USM respectively.

Table 1.3 Antinutrients composition of watermelon and wild melon

Samples	PHYTATE	OXALATE	SAPONIN	TANIN
SWM	0.15 ± 000	0.13 ± 0.00	0.42 ± 0.00	0.01 ± 0.00
USWM	0.66 ± 0.00	0.05 ± 0.00	0.02 ± 0.00	0.00 ± 0.00
SM	0.08 ± 0.00	0.06 ± 0.00	0.03 ± 0.00	0.00 ± 0.00
USM	0.9±0.01	0.95±0.20	0.12±0.00	0.01±0.03

It was observed that anti-nutrient, phytate is 0.15± 0.00, 0.66± 0.00, 0.08± 0.00, and 0.9 ± 0.01 for sample SWM, USWM, SM and, USM respectively, for oxalate is 0.13± 0.00, 0.05± 0.00, 0.06± 0.00, and 0.95 ± 0.20 for sample SWM, USWM, SM and, USM respectively, for saponin 0.42± 0.00, 0.02± 0.00, 0.03± 0.00, and 0.12 ± 0.00 for sample SWM, USWM, SM and, USM respectively for Tannin is 0.01± 0.00, 0.00± 0.00, 0.00± 0.00 and 0.01 ± 0.03 for sample SWM, USWM, SM and, USM respectively.

Table 1.3 Minerals composition of watermelon and wild melon

Samples	Na	Ca	P	Fe	Zn	Cu	Mn	Se	K
SWM	0.25	0.21	0.29	0.32	161.6	27.40	11.23	0.03	0.85
USWM	0.15	0.73	0.73	0.52	89.3	17.56	8.03	0.02	0.62
SM	0.16	0.52	0.24	0.24	86.50	16.80	7.16	9.33	0.10
USM	0.12	0.25	0.26	0.48	80.60	14.50	6.14	9.23	0.09

It was observed that the result for mineral was, for sodium is 0.25± 0.00, 0.15± 0.03, 0.16± 0.00, and 0.12 ± 0.00 for sample SWM, USWM, SM and, USM respectively, for potassium is 0.85± 0.01, 0.62± 0.00, 0.10± 0.00 and 0.09 ± 0.00 for sample SWM, USWM, SM and, USM respectively, for calcium is 0.21± 0.00, 0.73± 0.00, 0.52± 0.42, and 0.26 ± 0.00 for sample SWM, USWM, SM and, USM respectively, for magnesium is 0.29± 0.00, 0.52± 0.00, 0.24± 0.00, and 0.48 ± 0.00 for sample SWM, USWM, SM and, USM respectively. For phosphorus is 0.32± 0.00, 0.52± 0.00, 0.24± 0.00, for sample SWM, USWM, SM and, USM respectively, Zinc is 161.63± 0.15, 89.3± 0.10, 86.50± 0.20 and 80.60± 0.00 for sample SWM, USWM, SM and, USM respectively, for Copper it was 27.40± 0.10, 17.56± 0.20, 16.80± 0.10 and 14.50 ± 0.00 for sample SWM, USWM, SM and, USM respectively, for Manganese is 11.43± 0.15, 8.03± 0.15, 7.16± 0.41, for sample SWM, USWM, SM and, USM respectively, for Serium is 0.03± 0.00, 0.02± 0.00, 0.10± 0.13, and 9.23 ± 0.00 for sample SWM, USWM, SM and, USM respectively.

5.0 CONCLUSION

The analytical information obtained from this study has shown that melon "Citrullus lanatus" seeds are excellent sources of crude protein, crude fat and abundant in calories. Also, it is rich in micronutrients such as Iron, Potassium, Sodium, Vitamin A, B, and C., which are needed for body growth and development. It has a low concentration of anti-nutritional factors. The result suggests that the seeds are a good food source for humans and animals. Otherwise, the result shows that it is deficient in calcium, needed for bone formation and teeth development. Watermelon seed is an excellent source of minerals, Vitamins, protein, fat, and energy.

Therefore, there is not much difference in the nutritional composition of wild melon seed and watermelon seeds. Chewing watermelon seeds alongside the fruit cannot harm or cause any health challenges to humans.

5.1 RECOMMENDATION

The Government and Private sectors are urged to encourage large-scale farmers to participate in the cultivation of watermelon and melon because of their economic values and nutritional benefits, which would increase the Gross. Domestic Income of the nation at large and promote healthy living. It can also be recommended for human because they are a good source of iron which help to prevent anemia. It is a good source of protein that helps repair worn-out tissues and fat, which can be stored and into energy in the absence of carbohydrates.

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