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Comparative Analysis of the Proximate Evaluation and Heavy metal contents of the three varieties of *Solanum melongena*L. (Eggplant) collected from Iyana Iba market of OjoLocal Government Area in Lagos, Nigeria

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Abstract:
Background: The proximate analysis and Heavy metals contents of three varieties of *Solanum melongena* (Green, White and Agric Eggplants) gotten from Iyana-iba market were evaluated by standard procedures.
Materials and Methods: Metals were determined on filtrate of the pretreated sample solution by Atomic Absorption Spectrometry and test results were validated with calibration curves obtained with certified metal standards. Raw data collected were subjected to analysis of variance (ANOVA) meanwhile means of the samples were determined using (SPSS).
Results: The moisture contents have high values of 85.265±2.387%, 84.160±1.847%, and 82.520±1.790%. While the protein, ash, carbohydrate and fat content were relatively low in all varieties, Agric Eggplant was high with 1507.178±3005.215. The Ca+ contents was higher of all mineral elements analyzed with 6425.395±2765.920mg/100g, 6120.930±2167.846mg/100g, and 2167.865±89.810mg/100g. The mineral elements concentration was in this order; Ca > P > K > Mg > Na > Fe >Mn. The concentration of heavy metals determined revealed that Zinc has the highest value of all the metals and its concentration is observed to be highest in Agric Eggplant. The heavy metals (Co, Ní, Ar, Cu, Pb, Cd, Cr and Zn) were determined in the Eggplants to be below the permissible limits allowed for vegetables and so are considered safe for consumption. The other heavy metals are found either present in minute quantities in the varieties or even absent in some other.
Conclusion: The results revealed that all the varieties of eggplants were rich in nutrients and have rich mineral contents which make them nutritionally beneficial and are also free for consumption.
Keywords: Minerals, Concentration, Eggplants, Contents, *Solanum melongena*.

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I. INTRODUCTION

Eggplant, *Solanum melongena* L. is a common and popular vegetable crop grown in the different parts of the world and is a common vegetable in diet. It belongs to the family Solanaceae, the plant genus Solanum and sub-genus Leptostemonum[1]. Eggplant, (*Solanum melongena.*), *is* one of the most important vegetables worldwide. It ranks the fourth of world vegetable production after tomato, cucumber, and pepper. According to the Food and Agriculture Organization (FAO), a total production of 32,699,078 million tons of eggplants were produced on an area of 1,957,603 ha in 2008, more than 4 million tons of eggplants were produced on an area of 1,676,893 ha in 2009, and 46.8 million tons worldwide in 2011 [2,3,4]. It has over a thousand species all over the world. In Nigeria, about 25 different species have been recorded including those domesticated for food and local medicine [5]. In Northern Nigeria, it is called "Gauta" or "Yalo", the Yorubas call *Solanum melongena*"Igba", it is called "Yengi" in Nupe, "Afufa" or "Anara" in Igbo [6]. They are highly valued constituents of the Nigerian foods and folklore medicines. Although, they are mostly grown in the northern part of Nigeria [6], they are either eaten raw or cooked, used in making stew or soups [7] in the southern and western parts of Nigeria.

The shape of the fruit varies from ovoid, oblong, obovoid, or long cylindrical. Its composition has been recorded as per gram of edible portion is Calories Kcal, Moisture content,Carbohydrates, Protein (gram), Fat (gram) and vitamins (gram). Bitterness in egg plant is due to the presence of glycol alkaloids which are of wide occurrence in plants of Solanaceae family [8]. It may contain certain medicinal properties because medicinal uses of eggplant have been reported. For example, white eggplant is good for diabetic patients. It can cure toothache if fried egg plant fruit oil is taken. It has also been recommended as an excellent remedy for those suffering from

liver complaints and asthma [8]. Vegetables as rich sources of vitamins, minerals, and fibers, and also have beneficial antioxidative effects, their consumption is increasing gradually, particularly among the urban community. However, intake of heavy metal-contaminated vegetables and crops may pose a risk to the human health.

Many studies have reported negative or toxicity effects of the heavy metals. They are poisonous for macro and microorganisms through their direct influence on the biochemical and physiological processes, reducing growth, deteriorating cell organelles, and preventing photosynthesis and in crop plants; they are of great concern due to the probability of food contamination with heavy metals through the soil-root interface [9, 10.] Though the heavy metals are not essential for plant growth, they are readily taken up and accumulate by plants in toxic levels causing a toxic damage to cells and tissues as a result of the complex interaction of major toxic ions with other essential or non-essential ions [11, 12]. The aim of this study is to assess the concentration of heavy metals in the different varieties of *Solanum melongena*(eggplant) analysed and their mineral contents. To achieve this aim above, the following objectives will be required:

- To determine the heavy metals found in these varieties.
- To access the mineral contents present in the three varieties of Eggplants found in Nigeria.
- To ascertain which of the three species is fit for consumption.

II. MATERIALS AND METHODS

Sample Collection and Treatment: Samples of Green *Solanum melongena*, White *Solanum melongena*, and Agric *Solanum melongena* were collected at one-month interval for three months, on the 20th October,20th November and December 20th, 2020 respectively at Iyana-iba Market in Ojo Local Government of Lagos State, located in South Western Nigeria. Identification of the sample wascarried out at Botany Unit, Lagos state University, Ojo. All samples were washed, first with running water to remove the soil particles and microbes then with distilled water. The samples were then preserved by storage in clean sample bottles, at 4°C, until they are being analyzed. Before performing the analyses, the residual moisture was evaporated at room temperature. The samples were ground with a motar then shade-dried prior to analysis.

Proximate Analysis:

Moisture content: Moisture content was determined by drying the sample to a constant weight at 105^{o}C according to [13].

Ash content: Ash content was measured by calcination at 550^{o}C to a constant weight, according to [13].

Crude Protein content: Nitrogen content was determined according to the Kjeldahl method and nitrogen value was multiplied by 6.25 as a conversion factor [13].

Crude fibre content: Crude fibre was determined by Acid-alkaline-gravimetric method following the AOAC method [13].

Available carbohydrates: Available carbohydrate was estimated by difference using the relation: 100 - (% crude proteins + % crude lipid + % Crude fibre + % ash) [13].

Energy content: Energy content was estimated in kcal/100g by the Atwater general factors system. The percentage available carbohydrate, crude protein and crude lipid were multiplied by 4 and 9 respectively [14].

Sample extraction: 5g each of the samples were separately dried in an oven at 80℃, and then processed further by igniting at 550℃ for 4 hours, until ashed. The residues were then separately dissolved with 2 ml of dilute (1:1) nitric acid, and then made up to volume with distilled water, in a 50 ml volumetric flask. The solution was then filtered through Whatman #1 filter paper and then the filtrate was saved for the determination of the metals.

Digestion and measurement of Heavy metals (Cu,Cr,Cb,Pb): Heavy metals were digested and measured following the method described by [15].

Statistical Analysis:

Data were computed using statistical package for social sciences (SPSS/ version 20). The difference in the means were tested using three-way analysis of variance (ANOVA) while the significant level was calculated as $p<0.05$.

III. RESULTS

The result of proximate analysis, mineral and heavy metal concentration of the three varieties of *Solanum melongena*(the Green, White and Agric Eggplants) are summarized in the tables and figures below.

Table no 1: Proximate analysis of *Solanum melongena* in the three varieties of Eggplants of Ojo market.

	Varieties		
	Green Egg Plant	White Egg Plant	Agric Egg Plant
Moisture (%)	82.520±1.790	85.265±2.387	84.160±1.847
Crude protein (%)	4.510±.467	4.262±.851	4.650±.568

Crude fat (%)	0.827±0.075	1.010±0.151	0.635±0.316
Crude fibre (%)	4.790±0.989	4.035±0.667	1507.178±3005.215
Ash (%)	2.108±0.126	1.758±0.472	2.398±0.713
Carbohydrate (%)	5.655±2.127	3.670±1.842	4.148±2.246

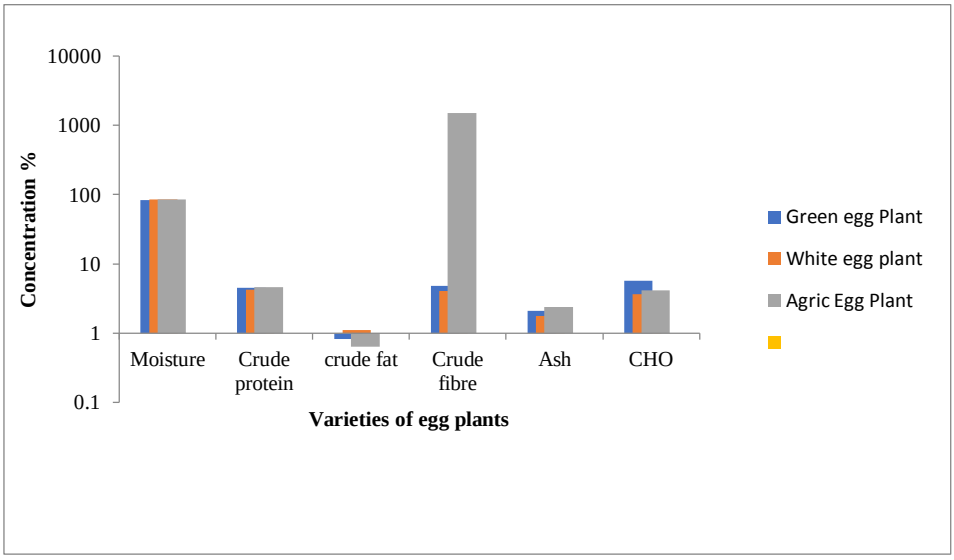

Figure no 1: Bar chart showing the proximate analysis of the three varieties of *Solanum melongena* found in Iyana-Iba Market.

Table no 2: Mineral contents of *Solanum melongena* in the three varieties of Eggplants of Ojo market.

	Varieties		
	Green Egg Plant	White Egg Plant	Agric Egg Plant
Calcium (Mg/Kg)	6120.930±2167.846	2167.865±89.810	6425.395±2765.920
Magnesium (Mg/Kg)	492.857±106.871	315.588±4.564	424.250±53.317
Sodium (Mg/Kg)	43.948±2.098	59.248±3.940	46.030±4.106
Potasium (Mg/Kg)	1996.713±70.529	3978.663±105.885	2121.850±125.544
Manganese (Mg/Kg)	4.088±1.257	1.813±.251	4.623±1.040
Phosphorus (Mg/Kg)	412.010±6.026	323.160±121.798	453.900±76.256

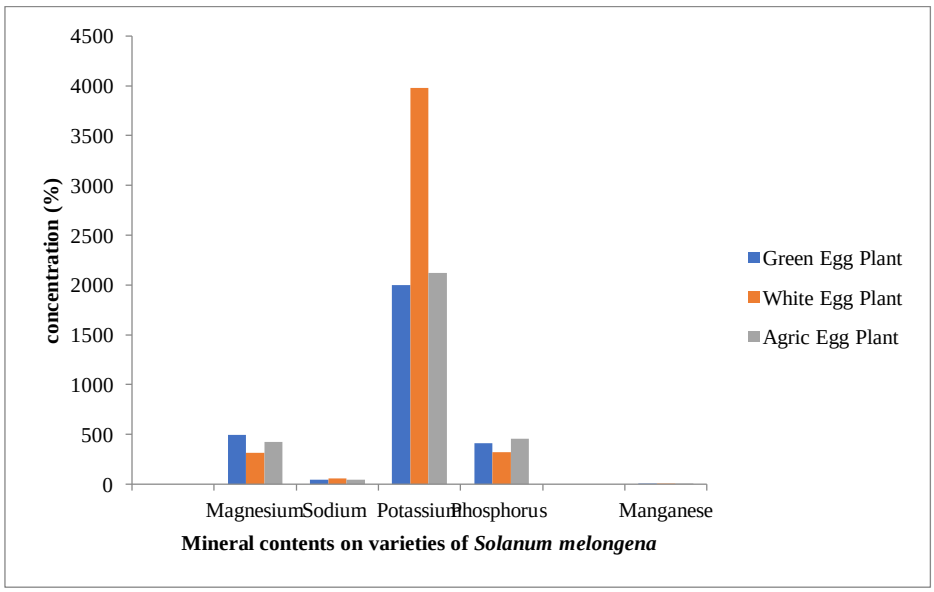

Figure no 2: Bar chart showing the mineral contents in all three varieties of *Solanum melongena* found in Iyana-Iba Market.

Table no 3: Heavy metal concentration of *Solanum melongena* in the three varieties of Eggplants of Ojo market.

	Varieties		
	Green Egg Plant	White Egg Plant	Agric Egg Plant
Iron (Mg/Kg)	14.108±4.234	18.615±1.355	14.545±1.200
Copper (Mg/Kg)	0.734±.486	0.055±.024	0.860±.327
Zinc (Mg/Kg)	3.443±.455	1.690±.738	3.970±.605
Selenium (Mg/Kg)	0.001±.001	.001±.001	.001±.001
Lead (Mg/Kg)	.001±.001	.000±.000	.006±.010
Chromium (Mg/Kg)	.010±.004	.002±.000	.008±.003
Cobalt (Mg/kg)	.002±.002	.000±.000	.001±.001
Nickel (Mg/Kg)	.000±.000	.000±.000	.000±.000
Arsenic (Mg/Kg)	.000±.000	.000±.000	.000±.001
Cadmium (Mg/kg)	.000±.000	.000±.000	.000±.000

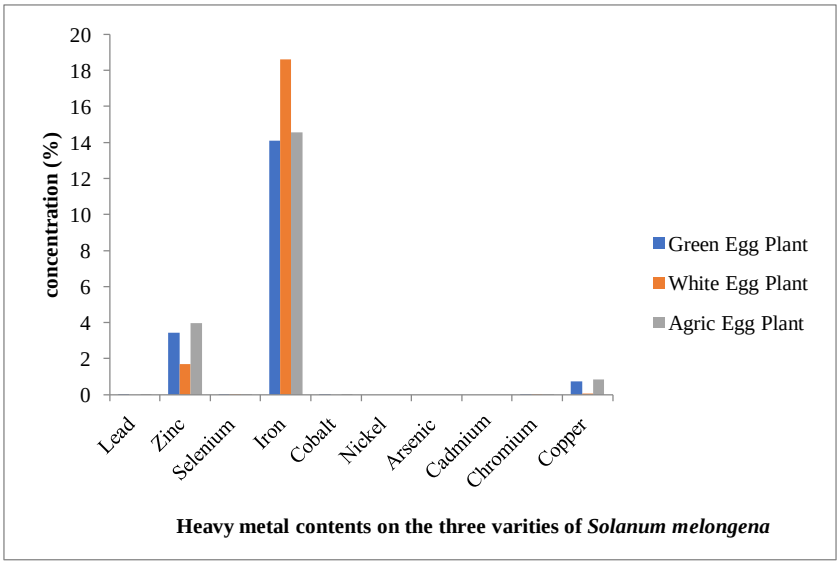

Figure no 3: Bar chart showing the concentration of heavy in all three varieties of *Solanum melongena* found in Iyana-Iba Market.

IV. DISCUSSION

Proximate Analysis:

Moisture Content (%): The moisture content of any food is an index of its water activity [16] and is used as a measure of stability and the susceptibility to contamination of microbes. However, the fibrous nature of the skin of eggplants makes it a bit difficult for microorganism to access. [17] reported that African eggplant fruits generally have high moisture content (about 75%) and low dry matter. The result of this analysis shows that the moisture contents are 85.265±2.387%, 84.160±1.847%, and 82.520±1.790 % for White Eggplant, Agric Eggplant and Green Eggplant respectively. All three varieties have moisture content % higher than that recorded by [17].This high moisture content also implies that dehydration would increase the relative concentrations of the other food nutrients and improve the shelf-life/preservation of the fruit. Therefore, the Green Eggplant recorded the lowest value for moisture content and so the consumption should be encouraged for its low moisture content.

Crude Protein (%): [1] reported Protein content in two varieties of eggplant, round and oval to be 5.79±0.22% and 4.58±0.40% respectively and these are higher than the values obtained in this study which are 4.650±0.568%, 4.510±0.467% and 4.262±0.851% for Agric Eggplant, Green Eggplant and White Eggplant respectively. The eggplant may therefore not be an ideal plant for protein supplementation. For protein content, the Agric eggplant should be consumed.

Crude Fat (%): Dietary fats are essential for the make-up and biological functions and integrity of cells and also increase the tastiness of food by absorbing and retaining flavours[18]. A diet high in fat is said to be implicated in certain cardiovascular disorders such as atherosclerosis, cancer and aging [18]. [19] reported that vegetables contain very little fats. Also, from this study, we obtained 0.827±0.075%, 1.010±0.151% and

0.635±0.316% in Green, White and Agric Egg plants respectively and this correlates with the little values reported by [19]. Eggplants may therefore be ideal fruits for individuals with high serum lipid levels, high blood pressure and other ischemic heart diseases and from this study, Agric Eggplant is best prescribed.

Carbohydrate (%): The percentage carbohydrate obtained in this study is 5.655±2.127% for Green Eggplant, Agric Eggplant with 4.148±2.246% and the White Eggplant with 3.670±1.842%. These results were found to be lower than those reported for papaya, apple, watermelon, guava, orange, prickly pear, apricot and paprika seeds which were in the range of (8.54 – 34.74 %) by [20]. The recommended net energy that vegetables should provide from its Carbohydrate according to [21] and [22] experts consultations is 55%-75%. The low carbohydrate level of eggplant varieties makes them good for diabetic patients and individuals watching their weight [1, 23]. All three Eggplants varieties are okay for consumption, but the White Eggplant has the lowest % of carbohydrate and would be recommended for persons who desire low carbohydrate level Eggplant.

Ash (%): The ash level shows the degree of the inorganic matter. The result for Ash content in this study shows highest in Agric Eggplant (2.398±0.713), the next is Green Eggplant (2.108±0.126) and the White Eggplant is the lowest with 1.758±0.472 as its mean values. These values obtained from this study were higher than those in the work of [1] which was within the range of 1.81±0.86% - 1.78 ±0.13% but lower than that recorded by [24] which was 7.10±0.38%. It therefore implies that the three varieties studied have considerable concentration of mineral elements because of their ash content level. The Agric Eggplant is most preferable for consumption as regards these mineral elements because it has the highest ash content according to this study.

Crude Fibre (%): The high crude fiber, low fat and low dry matter of the eggplants helps in preventing certain diseases such as constipation, atherosclerosis of the colon and rectum and carcinoma [25]. Water and fiber in foods increase volume of the food and thereby reduce its energy density. It has been shown that in their natural state, fruits and vegetables have high water and fiber content and are low in calories and energy density [26]. The recommended level for Crude fibre in food by FAO is 22.5%. The Agric variety from this study recorded a value of 1507.178% which is way above the recommended level and so is considered not safe for consumption.

Mineral Contents

Calcium (Mg/100g): Calcium, a mineral required by the body for a variety of physiological functions and for the maintenance of bone tissues throughout life, needs to be consumed in adequate amounts each day, preferably from foods rather than supplements (Foods First, Supplements Second). The values for calcium in this present study are 6425.395, 6120.930, and 2167.865 for Agric Eggplant, Green Eggplant and White Eggplant respectively. [27] reported that S. *melongena, S. atheopicum and S. macrocarpon* had Ca^{2+} concentration of 1.64mg/100g, 9.03mg/100g and 3.31mg/100g respectively. These values were way lower than the values obtained in the present study. The Ca^{2+} level from different fruits and vegetables in the German food composition in the work of [28] was within the range of 4-11 mg/100g which is still very low compared to those in the present study. The recommended value for calcium consumption in vegetables is 1000mg/kg. The three varieties of Egg plants are therefore good sources of calcium ion and may be used as supplements in diets low in calcium ion, but they are way far from the recommended limit and so may be unsafe for consumption.

Magnesium (Mg/100g): Magnesium was found to be highest in Green Eggplant (492.857±106.871), Agric Eggplant is next with 424.250±53.317 and White Eggplant has the least value with a very large difference of 315.588±4.564.

Sodium (Mg/100g): Sodium is essential to health and resides in the extracellular fluid, regulating plasma volume as well as cellular transport. It serves many physiological functions, including nutrient absorption and maintaining fluid balance. Humans can obtain sufficient sodium from the low amounts present in many foods, including fresh meat, fish, and vegetables, but most of the sodium we now consume is added in food processing or at the table. In most of the world's populations, sodium intake greatly exceeds the minimal physiological need. Although small amounts of sodium are necessary for health, too much may cause health problems. For example, because sodium affects fluid regulation, a high sodium intake may increase blood pressure through volume expansion [29]. The values recorded by [30] in their study for Na^+ *S. Melongena* which is 170 mg/Kg is greater than the values recorded in this study which are 43.948 mg/Kg, 59.248 mg/Kg and 46.030 mg/Kg for Green, White and Agric Egg plants respectively. This implies that all three varieties of *Solanum melongena* are safe for consumption, but the Green variety is the safest when it comes to sodium content.

Potassium (Mg/100g): Potassium works with sodium to maintain the body's water balance. The kidneys regulate the level of potassium in the body. It is known that high sodium intake may lead to hypertension. Consequentially, reduction in sodium helps lower blood pressure in all people with hypertension (A diet low in potassium and high in sodium may be a factor in high blood pressure). High potassium has been reported to have a protective effect against excessive sodium intake. [31], suggested that a ratio of sodium ion to potassium ion less than one ($Na^+/K^+ < 1$) would be suitable for reducing high blood pressure. Potassium is also involved in nerve function, muscle control and blood pressure. Increasing potassium in the diet may protect against hypertension in people who are sensitive to high levels of sodium. Potassium deficiency is not common but may

result from excessive losses due to severe diarrhea, poor diabetic control, low-calorie diets (less than 800 calories per day), chronic alcoholism, hard exercise, or some diuretics and laxatives. In this study, the potassium content is 1996.713mg/Kg, 3978.663mg/Kg and 2121.850mg/Kg. This is way greater than the values recorded by [30] in their study for K^+ in *S. Melongena* which is 230 mg/Kg.

Manganese (Mg/100g): Manganese is one of the essential trace elements of the photosynthesis process, being involved in water photolysis and oxygen production. It has a role in the processes of synthesis of chlorophyll and ascorbic acid, and the accumulation of copper, magnesium [32]. Manganese is transported in the body by transferrin, macroglobulins and albumin. It is involved in enhancing normal skeletal growth, functions with vitamin K in the formation of prothrombin. It is important for the utilization of glucose, metabolism of lipid, cholesterol metabolism, pancreatic function and enhancement of fertility [33]. The manganese concentration as reported by [34] for *Melongenawhytii* (6.2±0.15mg/Kg) was higher than values obtained for all the eggplant varieties in this study.

Phosphorus (Mg/100g): Phosphorus is also an essential nutrient that must be consumed in amounts that support both extracellular and cellular functions, but which are not so excessive compared to Ca as to adversely alter the Ca homeostatic mechanisms. Too much dietary P relative to Ca contributes to persistent losses of Ca, which over an extended period of time must negatively affect bone mass. The values for P from this study are 453.900 Mg/kg, 412.010 Mg/kg and 323.160Mg/kg for Agric Eggplant, Green Eggplant and White Eggplant respectively. These concentrations are minute when compared to the calcium level and so the three varieties are safe for consumption. The mean values obtained for the three varieties are well above the permissible limit recommended for vegetables by WHO which is 70mg/kg. And so none of them is safe for phosphorus consumption.

Heavy Metal Contents

Iron (Mg/100g): Iron is required in the body for haemoglobin production [35] is necessary for oxygen transportation from the lungs through the blood stream to the tissues. Myoglobin, a protein in muscle, also contains iron which stores oxygen for use during muscle contraction. The iron content of several fruits and vegetables which have been analyzed by many authors are within the range of 0.1- 1.8 mg/100g [36]. The concentration of iron for White Eggplant in this study alone is found to be within the range of the Fe concentration of eight edible fruits analyzed by [37], (15.23±0.19 to 35.55±0.47mg/100g) and it is 18.615±1.355mg/100g. 14.108±4.234mg/100g and 14.545±1.200mg/100g are values for Green Eggplant and Agric Egg plant varieties respectively. The WHO permissible limit for Iron intake in vegetables is 48mg/kg and it makes the three varieties safe for consumption.

Copper (Mg/100g): Copper is involved in the process of erythropoiesis, erythrocyte function and regulation of red blood cell survival. High doses of copper can lead to diarrhea, epigastric pain and discomfort, blood in the urine, liver damage, hypotension and vomiting [33]. Copper in small concentrations is very useful plant trace elements involved in the synthesis of chlorophyll, ascorbic acid, catalyze redox reactions, and stimulates the activity of enzymes. In high concentrations it is considered a heavy metal, harmful, and currently has 10mg/100g as its permissible level in vegetables according to [38]. The fruits of Eggplant according to the study by [39] show a copper content concentration of 0.97mg/100g and 1.05mg/100g. This result is found to be in the same range with this particular study where the copper content of the Green Eggplant, White and Agric with the figures as 0.734±.486mg/100g, 0.055±0.024mg/100g and 1.537±0.549mg/100g respectively. The three varieties are safe for consumption as their copper content is found within the limit by WHO.

Zinc (Mg/100g): Rather than being a toxic metal ion, zinc is an essential trace element. It is relatively harmless compared to several other metal ions with similar chemical properties. Being exposed to high doses is what has toxic effects, making acute zinc intoxication a rare event. High-dose zinc supplementation interferes with the uptake of copper (many of its toxic effects are in fact due to copper deficiency). One organ where zinc is prominently involved in cell death is the brain, and cytotoxicity in consequence of ischemia or trauma involves the accumulation of free zinc. Whereas intoxication by excessive exposure is rare, zinc deficiency is widespread and has a detrimental impact on growth, neuronal development, and immunity, and in severe cases its consequences are lethal. Zinc deficiency caused by malnutrition and foods with low bioavailability, aging, certain diseases, or deregulated homeostasis is a far more common risk to human health than intoxication [40]. The fruit concentration of zinc varies between 0.21 mg/kg and 0.72 mg/kg from the study of [39]. The result from this study revealed 3.970mg/kg, 3.443mg/kg, and 1.690mg/kg respectively for Agric Eggplant, Green Eggplant and White Eggplant in that order. These values are found within the maximum permissible concentration in vegetables for Zn which is 5 mg/kg [32], thus the three varieties are fit for consumption.

Selenium (Mg/100g): Selenium (Se) is an essential micronutrient for human and animal health due to its capabilities to support antioxidant defense systems but is harmful in excess [41]. Selenium is required by humans and other mammals. It is well established that Se is an essential nutrient for human health [42], and an insufficient

supply causes or predisposes to disease. The concentrations of Se in all three varieties were found to be 0.001 Mg/Kg.

Lead (Mg/100g): The toxic effects of Lead focus on several organs, such as liver, kidneys, spleen and lung, causing a variety of biochemical defects. The nervous system of infants and children is particularly affected by the toxicity of this heavy metal. Adults exposed occupationally or accidentally to excessive levels of Pb exhibit neuropathology. There is association between Pb in human body and the increase of blood pressure in adults [43]. Although Pb effects are more relevant for children, calculations for risk assessment were made for adults and children. The eggplant fruit variation of lead content in the work [39] was between 0.02 mg kg^{-1} and 0.46 mg kg^{-1}. The values for the Green and Agric Egg plants are 0.001 mg kg^{-1} and 0.006 mg kg^{-1} respectively while Pb is completely absent in White Eggplant. [44] recommended a permissible limit for Lead in vegetables is 2mg/kg. The values are way below the permissible level and so the Egg plant varieties are safe for consumption.

Chromium (Mg/100g): Chromium is an important element for the insulin activity and DNA transcription. However, an intake below 0.02 mg per day could reduce cellular responses to insulin [45]. The daily intake of Cr estimated in this (0.010Mg/100g, 0.008M g/100g, and 0.002Mg/100g) work was in the same range with what was reported in literature, which ranges between 0.013 and 0.098 mg per day [46]. 1.30mg/kg is the permissible limit for Chromium in vegetables as recommended by [44]. The result of the heavy metals analysis in this study shows that the three varieties are safe for consumption as regards Chromium.

Cobalt (Mg/100g): Cobalt is a constituent of the B12 vitamin. The estimated daily intake of Co was 0.040 mg, which represents 1.3 % of the Real food daily established as 3 mg per day [47]. There are few data on Co intake. Data in the literature range between 0.012 and 1.2 mg per day [46,48]. Cobalt content was found to be highest in Green Eggplant (0.002Mg/100g), Agric Eggplant is next with 0.001Mg/100g and it is absent in the White Eggplant variety. These values are way lower compared to the values from the literature. [38] provided 0.4mg/kg as the permissible limit for cobalt, this makes the Eggplants cobalt-poisoned free.

Nickel (Mg/100g): Nickel does not have a specific function in humans; however, it is a co-factor for some microbial intestine enzymes. Nickel content in the adult human body should remain below 0.1 mg per day, and excess may cause damages to DNA and cell structures [45]. From the heavy metal analysis of the three varieties, there was no significant concentration for nickel (0.00).

Cadmium (Mg/100g): Cadmium is a dangerous element because it can be absorbed via the alimentary tract, penetrate through placenta during pregnancy, and damage membranes and DNA. Once in the human body, it may remain in the metabolism from 16 to 33 years and is connected to several health problems, such as renal damages and abnormal urinary excretion of proteins. Decrease in bone calcium concentrations and increase of urinary excretion of calcium have also been attributed to exposure to Cd, eventually causing death. It also affects reproduction and endocrine systems of women [49]. Vegetables may contribute to about 70% of Cd intake by humans, varying according to the level of consumption [50]. The Cd contents of eggplant ranged from 0.07 to 0.48 mg kg-1 in the study of [51].Permissible Limits of cadmium in vegetables is within the range of 0.1-1.5 mg kg-1 [44]. Cadmium was observed to be absent in the result of the analysis, thus all three varieties are safe for consumption.

Arsenic (Mg/100g): Arsenic contamination in natural water is a worldwide problem and has become an important issue and challenge for the world engineers, scientists and even the policy makers. For example, chronic arsenic toxicity due to drinking arsenic-contaminated water has been one of the worst environmental health hazards affecting eight districts of West Bengal since the early.1980s. Detailed clinical examination and investigation of 248 such patients revealed proteanclinical manifestations of such toxicity. Over and. above hyperpigmentation and keratosis, weakness, anaemia, burning sensation of eyes, swelling of legs, liver fibrosis, chronic lung disease, gangrene of toes, neuropathy, and skin cancer are some of the other manifestations [52]. Arsenic was observed to be absent in the result of the analysis, thus all three varieties are safe for consumption.

V. CONCLUSION

The variations that occur in the eggplant's varieties do not end at their morphology level only but also in the composition of their various nutrients and their mineral element contents. Eggplants have appreciable contents of nutrients which make them nutritionally beneficial. These nutrients include moisture, ash, crude fibre, carbohydrate, protein and fat. According to the proximate analysis, the Agric *Solanum melongena* appears to be more nutritionally endowed as it has more ash, crude fibre and protein contents. White *Solanum melongena* is found to be the best for consumption of Carbohydrate and fat. Some mineral elements such as Calcium, Magnesium, Sodium, Potassium, Phosphorus, Iron and Manganese were observed in appreciable amounts that are useful to the body. The contents of heavy metals (Cobalt, Níckel, Arsenic, Copper, Lead, Cadmium, Chromiun and Zinc) were determined in the *Solanum melongena* to be below the permissible limits allowed for vegetables. Hence, the three varieties of *Solanum melongena*analysed in this study are not only nutritionally advantageous but also free from heavy metal contaminations and thus free for consumption.

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