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Comparative Study on the Nutritional Profiles of Selected Varieties of Watermelon, Banana, Avocado fruits in Ogun State Nigeria

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ABSTRACT

Results of analysis conducted to determine the nutritional profiles of selected varieties of water melon, banana and avocado pear show that banana has the highest carbohydrate concentration 21.96 mg/ml followed by avocado pear 7.75g/ml and watermelon with the least carbohydrate concentration 5.90g/ml. Avocado pear showed the highest protein content with about 2.25mg/ml while watermelon has the least value, about 0.70mg/ml, banana only showed values of about 1.30mg/ml. The pH values of these fruits are all within acidic range with banana as the lowest 5.10, followed by avocado 5.15, and watermelon as the highest pH value 6.0. The titrable acidity of watermelon was highest at 6.4, followed by avocado/pear 5.22 and banana 5.30. The moisture content of watermelon showed the highest value of about 92.05 followed by avocado pear with about 71.05 and the least was banana with about 68.3. The ash content of the fruits was least with avocado pear with about 1.2 while banana had about 5.60, and the highest was watermelon with about 7.00. Watermelon has the highest fiber about (37.14) followed by avocado pear (10.86), and the least was banana (8.71). Avocado showed the highest value in calcium with about 52.0 mg, then banana with 24.5 mg and the least was watermelon with 10.5 mg. Banana has high amount of phosphorus with 42.2 mg, avocado had 35.5 mg while watermelon had 25.02 mg. Zinc in watermelon was 1.84mg/100g, banana had the least value 1.79mg while avocado had the highest value at 2.85 mg. Iron content in watermelon is highest with about 3.02 mg, avocado had 2.07 mg while banana had 3.0mg. Water melon also showed the highest vale in magnesium at 75.02 mg with avocado pear following closely at 72.08 mg while banana was the least at 70.05mg

Keywords : Water Melon, Banana, Avocado, Protein, Fibre

I. INTRODUCTION

One of the most significant aspects of our diet is constituted by fruits such as oranges, lemon, pineapple, pear, banana, watermelon, bell apple, English apple, star apple, grapes, berries, etc. These fruits are cultivated in local farms, orchards, gardens and plantations in local communities in form of fruit trees. Fruits contain vitamins and phenolics, (e.g. flavonoids, glucosides, hydroxycinnamic acids (Marchland, 2002) and carotenoids (Rao and Rao, 2007). Fruits are also rich in minerals, carbohydrates in form of soluble sugars, cellulose and starch (Nahar *et al*, 1990). They are very vital portion of human diet and serve as food supplements and appetizers. Fruits are also consumed because of the health role they play in our body. Vitamin C is important in maintaining and controlling of scurvy in case of deficiency (Holley *et al*, 2011). It also assists in the maintenance of cell membrane integrity especially in cutaneous and sub-cutaneous

cells. Vitamin A helps in healthy teeth, skeletal and soft tissue, and mucosa membrane and improves the eye sight. Vitamin E protects body tissue against damage from free radicals and helps in maintaining membrane integrity (Oski and Barness, 1998). Fruits, seeds, and leaves, of many wild plants form ingredients in a variety of traditional native dishes for the rural populace in developing countries (Humphrey *et al*, 1993). Despite the importance which fruits occupy in our nutrition and consequently health care system, they are hardly accorded the significance they deserve in our agriculture system. Fruits have high potentials to play crucial role in healthy population diets of the future (Clune *et al.,* 2017). A fruit can be defined as the fleshy or dry ripened ovary surrounding the seed of a plant. However, a pomologist may define fruits are the fleshy edible part of a perennial plants associated with the development of flowers. The improvement in technology and consideration of the fruits in the most favored climate of the world has been responsible for the steady increase in yield. However, in spite of all these, the total acreage or number of plants devoted to al fruits has dropped or remain about the same or has not risen in proportion to the increase in the respective crop production (Norman, 2017). Fruits can be used in making some type of drinks, juices, smoothies, beverages which benefit the body. (McGee, 2004). They can also be fermented to make alcoholic beverages such as brandy and wine. Vinegar can also be made using fruits such as apple and grape. Some fruits are usually used to make oil especially olives which when pressed under cold conditions, can be used to make virgin olive oil. Berries which are also some type of fruits can also be used to make peppers, paprika, and other food spices (Farrell and Kenneth. 1999). Vanilla is also a flavor/spice used in iced cream making, yoghurts making, cakes etc derived from fruits (Farrell *et al*, 1999). Banana is an edible fruit – botanically a berry (Armstrong and Wayne, 2011) – produced by several kinds of large herbaceous flowering plants in the genus Musa.(Merriam Webster, 2013). Almost all modern edible parthenocarpic (seedless) bananas come from two wild species – Musa acuminata and Musa balbisiana. The scientific names of most cultivated bananas are Musa acuminata, Musa balbisiana, and Musa paradisiaca for the hybrid Musa acuminata × M. balbisiana, depending on their genomic constitution. Bananas are rich sources of potassium (Kraft, 2011). Potassium can be found in variety of fruits, vegetables and even meats, however, a single banana provide 23% of the potassium that the body needs on a daily basis. Potassium benefit the muscle as it helps maintain their proper working and prevents muscle spasms. Potassium can also help to decrease blood pressure and reduce risk of stroke. Banana are healthy source of vitamin A which aids in healthy teeth, bones and soft tissues etc. vitamin B6-which aids the body immune system, promote brain health and heart health etc. vitamin C which aids in healing of wounds, growth of tissues, and ligaments. The avocado (Persea americana) is a tree, long thought to have originated in South Central Mexico, (Chen, Morrell, Ashworth, 2008) classified as a member of the flowering plant family Lauraceae (Morton,1987). Avocado refers to the tree's fruit, which is botanically a large berry containing a single large seed. They have a green-skinned, fleshy body that may be pear-shaped, egg-shaped, or spherical. Commercially, they ripen after harvesting. Avocado trees are partially self-pollinating and are often propagated through grafting to maintain a predictable quality and quantity of the fruit. Avocadoes contain wide variety of nutrients including about 20 different vitamins and minerals. Some of the most abundant nutrients in avocadoes are vitamin K, folate, vitaminB5, vitamin B6, potassium, vitamin and small amounts of magnesium, zinc, iron, copper, manganese, phosphorous, vitamin, vitamin B1(thiamine), vitamin B2(riboflavin), vitamin B3(niacin) and vitamin E (Dreher and Davenport , 2013). Avocadoes contain more phosphorus than that found in bananas. Avocadoes also contain calories, protein, health fats. It has high fibre and low carbohydrate making avocadoes a friendly fruits for

those who avoid high carbohydrate content foods. Avocadoes are devoid of cholesterol or sodium and low in saturated fat. This is why the fruits are favored by many. Avocado is a high fat fruit, making it the fattiest plant fruits in the world. The majority of the fats in avocadoes are oleic acid (Nutriondata.com, 2013). This is monounsaturated fatty acid that is also the main component in olive oil responsible for its health benefit. Eating avocado can lower cholesterol and triglyceride levels. They are also loaded with antioxidant such as lutein and zeaxanthin which are incredibly important in maintaining a healthy eye (Dreher and Davenport, 2013). Watermelon belongs to the family of Cucurbitaceae, of the genus Citrullus and related to Cantaloupe, Squash and Pumpkin that runs as vine on the ground surface. It is widely grown in most tropical countries as a major commercial fruit crops. The botanical name of watermelon is *Citrullus lanatus.* Watermelon is rich in electrolytes and 91% water and 6% sugar (Nutritional data, 2014). They have low calories (30 calories per 100g) and carry minimal fats. It has variety of health promoting phytonutrients and antioxidants essential for optimal health. Watermelon is an excellent source of vitamin A and flavonoids like lycopene, B-carotene, lutein, zeaxanthin and cryptoxanthin (Perkins-Veazie, Collins, Davis, Robert, 2006). These antioxidants offer protection against colon, prostrate, breast, endometrial, lung and pancreatic cancers. Lycopene and carotenoids so far discovered can protect cell and other structures from free-oxygen radicals. Watermelon is a good source of some vitamins and minerals such as potassium, vitamin c, vitamin B6, thiamin and manganese which is used as a co-factor for the antioxidant enzyme, superoxide dismutase and amino acid citulline is produced in watermelon rind (Rimando, Perkins-Veazie, 2005). Although watermelon can be grown in all the seasons under tropical control environments they are best grown during the months of summer. The organically grown watermelons are richer in taste and nutrients

Epidemiological study has indicated a strong inverse relationship between the consumption of fruits and vegetables and the incidence of degenerative diseases. There is considerable evidence that antioxidants contained in fruits and vegetables play an important role in the maintenance of health and prevention of disease. Many fruits have medicinal value as a result of phytochemicals they possess (Joseph and Raj, 2010). The benefits of fruits are numerous; they reduce oxidative stress drastically (Agudo *et al*, 2007). Risk of chronic disease can be reduced by the regular consumption of fruits. It has been discovered that avocado pear contain sufficient amount of phosphorus. Apart from the acceptable fat it contains, it also vitamin C, B6, K, potassium (Dreher and Davenport, 2013). Banana contains iron, phenolics, and a low glycemic index. Watermelon contains sufficient amount of vitamin C that prevents scurvy and enhances membrane integrity. Proximate analysis refers to the determination of the different macronutrients such as moisture, ash, crude fiber, crude fat, crude protein and carbohydrates. These macronutrients can be determined using oven drying method, dry ashing method, Weende method, Sohxlet extraction method, Kjeldhal method and chromatographic method respectively based on the Official Methods of Analysis of the AOAC International (AOAC, 2011). Moisture content is one of the properties that is important for nutritional labeling, food quality, and microbial stability while ash content is a measure of the total amounts of minerals present within a food (McClement, 2003). Fat content in food plays a major role in determining the overall sensory characteristics, such as flavor, texture, mouth feel and appearance (McClements, 2003). Lastly carbohydrate content is the amount of sugars and polysaccharides in food while the crude fiber content is the estimate of the indigestible fiber in food (McClements, 2003). The quantitative determination of some amino acids and nutritional components of selected tropical fruits like watermelon, mango etc., has been studied using chromatographic

method. (Madu and Bello, 2018). The samples were prepared as for other analysis, filtered and kept for analysis using HPLC. The chromatographic system was a KNAUER HPLC instrument (Knauer, Berlin, Germany) consisting of a K-1000 Knauer controller Quaternary pump, a Spark Triathlon autosampler and a fluorescence detector (Shimadzu, RF-551) operating with the Chromgate 3.7 software. Separations were achieved using a spherimage 250mm×4 mm, reversed-phase ODS column (Knauer; Berlin, Germany). For OPA/MPA derivatives the eluent system consisted of two components: eluent (A) was methanol–sodium phosphate (pH 6.5, 12.5 mM) (10:90, v/v), while eluent (B) was methanol– tetrahydrofuran (97:3, v/v).

II. METHODS AND MATERIAL

Experimental

The watermelon, avocado/pear, and banana were purchased from Lusada market, Igbesa, Ogun state, and identified by a taxonomist for analysis. The samples were washed, peeled and cut into sizes before blending and homogenizing, after which they were filtered and centrifuged. The filtrate was stored in a refrigerator at a temperature below 4ºc for further analysis. The analysis of carbohydrate was carried out using Anthrone method. Carbohydrates are first hydrolyzed to simple sugar using dilute hydrochloric acid which hydrolyses the glycosidic bond to yield the monomeric units which are then dehydrated to furfural and its derivatives. The furfural reacts with Anthrone reagent to form a blue green colored product with an absorption maximum at 620nm. The absorbance is related to the total sugars present. The Anthrone reaction is a rapid and convenient method of determining total hydrolysable sugars available in a given carbohydrate. 4ml of Anthrone reagent was added to 1ml of test solution which was earlier diluted with 99ml of water so as to reduce the concentration, after which the 1ml was taken and mixed rapidly. The tubes were placed in a boiling water bath at 100 ºC for 10 minutes with a marble on top to prevent the loss of water by evaporation and cool and the extinction was read at 620nm against a reagent blank (AOAC, 1990). Protein was determined using the Biuret method. Under alkaline conditions, substances containing two or more peptide bonds form a purple coloured complex with copper salts in the reagent. The color is stable, but all readings should be taken within 10 minutes of each other. The biuret test is fairly reproducible for any given protein, but it requires relatively large amounts of protein (1-20 mg) for color formation (AOAC, 1990). Moisture content was determined by conventional oven method. Ash content, a measure of the total amount of minerals present within a food sample was determined by wet ashing method. For the fibre content was determined by digestion of defatted sample with 1.25% H_2SO_4 and then filtered using filter paper by suction in conjunction with Buchner funnel. Ascorbic acid analysis was carried out according to Rahman et al. (2007). Ascorbic acid oxidized to dehydroascorbic acid by using bromine water. After that L-dehydroascorbic acid reacts with 2, 4-DCPIP and produces an osazone, which treated with H_2SO_4 forms red colored solution. The pH of the samples was determined by using the pH meter. 20ml of test solution will be measured m. The resulting suspension was determined by a pH meter already standardized with buffer 4.0 and 7.0 (AOAC, 1990). The acidity of the tropical fruit pulp was estimated based on AOAC [174] standard procedure. For the determination of acidity, two gram of fruit pulp was diluted with 20 ml distilled water and titrated with 0.1N NaOH using a few drops of 1 % phenolphthalein solution as indicator. The titration value (T.V) was noted and the acidity of the sample was calculated using the following formula and expressed as percentage of citric acid.

III. RESULTS AND DISCUSSION

The comparative study on the nutritional profiles of selected varieties of watermelon, banana, avocado

fruits in Ogun State Nigeria has been conducted and results are as shown

Table 1. Values are presented as mean ± standard deviation of two determinations

Nutritive Content	Sample		
	Watermelon	Banana	Avocado
Carbohydrate(mg/ml)	5.90±0.40	21.96±0.94	7.75±0.55
Protein (mg/ml)	0.70±0.10	1.30±0.20	2.25±0.25
Vitamin C (mg/ml)	8.50±0.50	7.20±0.70	8.75±0.25
pH	5.15±0.15	5.10±0.40	6.00±0.00
Acidity (%)	5.30± 0.40	5.22±0.28	6.40 ±0.20
Moisture Content (%)	92.05±0.45	68.3±0.30	71.05±4.35
Ash Content (%)	7.00±2.00	5.60±1.20	1.20±0.80
Fiber Content (%)	37.14±4.00	8.71±1.57	10.86±1.43

Table 2. Values of the mineral concentration presented as mean ± standard deviation of duplicate determination.

Mineral Content (mg/100g)	Sample		
	Watermelon	*Banana*	*Avocado*
Zn^{+}	1.84±0.20	1.79±0.05	85±0.17
Mg^{2+}	5.02±0.12	70.05±0.05	72.08±0.02
Fe^{2+}	3.20±0.07	3.00±0.10	2.07±0.01
Ca^{2+}	10.5±0.05	24.5±1.50	52.0±10.1
P^{+}	25.02±0.50	42.20±0.50	35.05±0.10

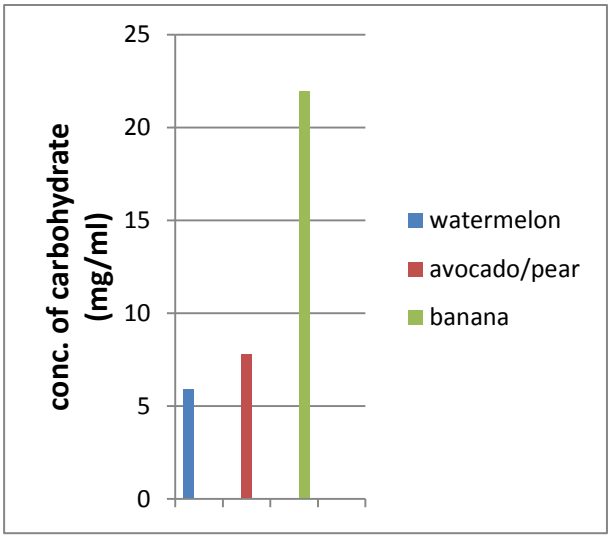

Fig 1: showing the bar chart of carbohydrate concentration

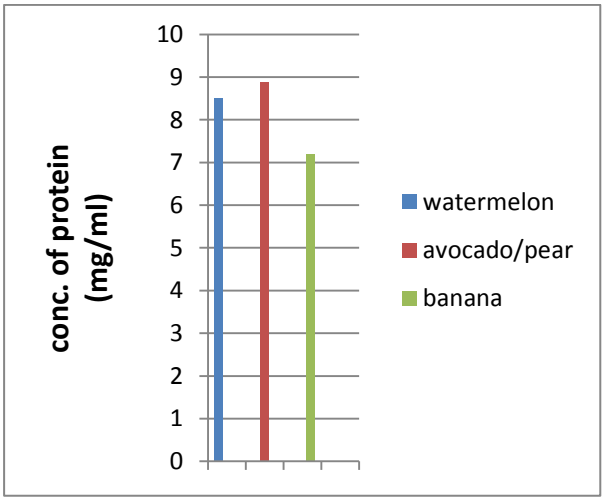

Fig 2: showing the bar chart of protein concentration

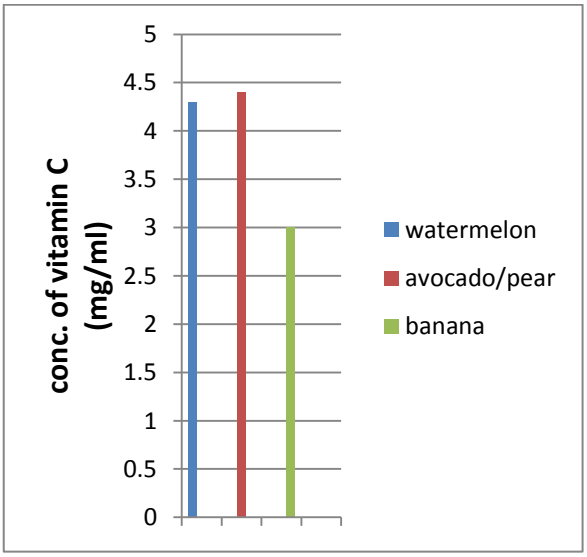

Fig 3: showing the bar chart of vitamin C concentration.

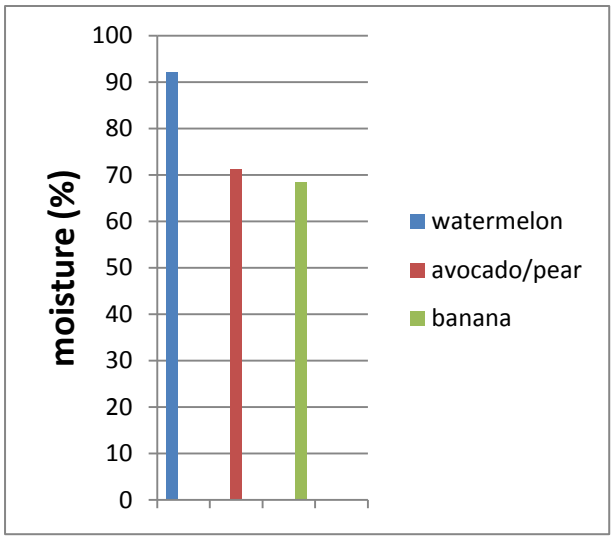

Fig 4: showing the bar chart of moisture concentration

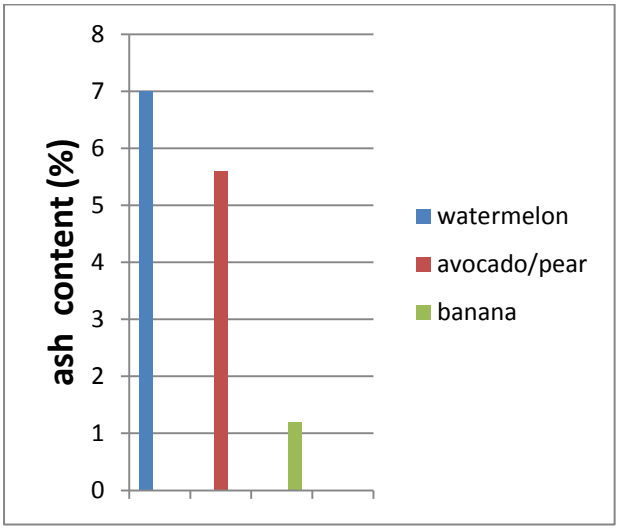

Fig 5: showing the bar chart of ash content concentration

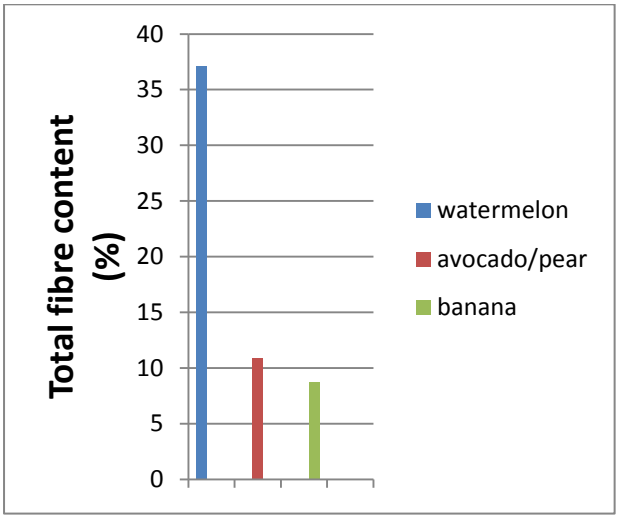

Fig 6: showing the bar chart of crude fiber concentration

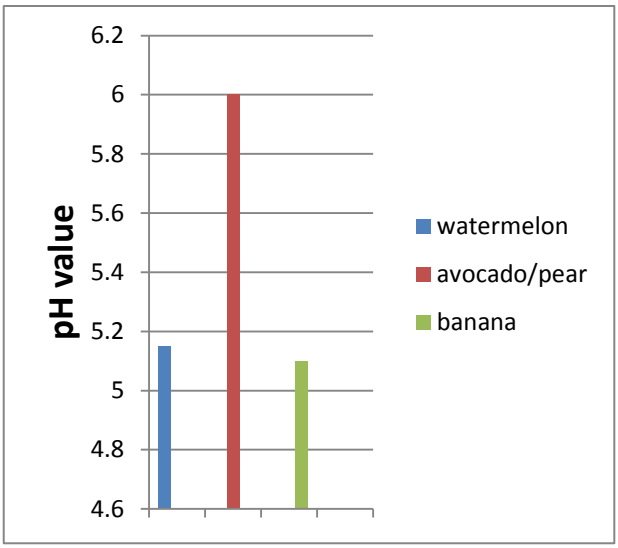

Fig 7: showing the bar chart of pH concentration.

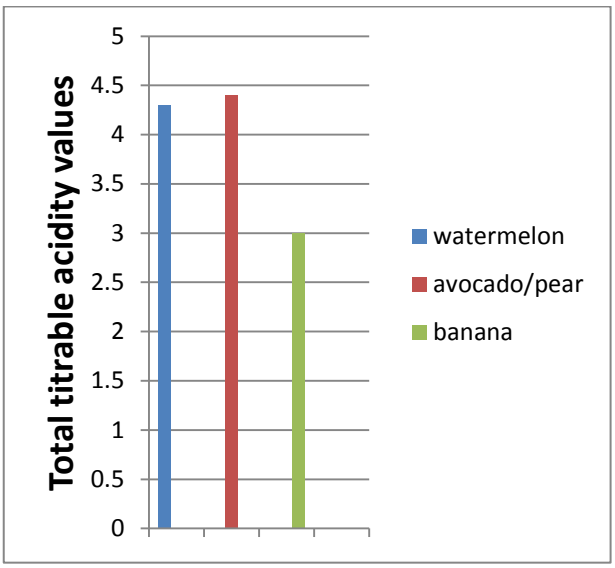

Fig 8: showing the bar chart of total titrable acidity concentration.

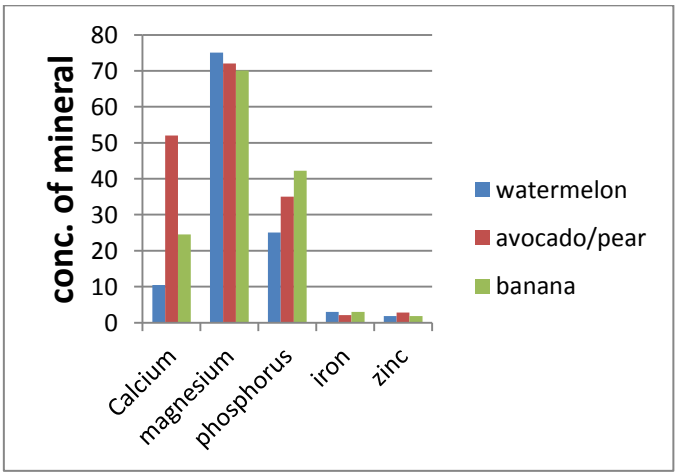

Fig 14: showing the bar chart of mineral content of the different fruits sample.

IV. DISCUSSION

The values obtained in the analysis of watermelon, avocado/pear and banana for carbohydrate, vitamin C, protein, pH, and titrable acidy and mineral contents are shown in tables 1 to 3 above. From the results showed in Table 1, using anthrone method banana has the highest carbohydrate concentration 21.96 mg/ml followed by avocado pear 7.75g/ml and watermelon which showed the least carbohydrate concentration 5.90g/ml. Carbohydrate provides energy to the body, people requiring quick source of energy should take more of these carbohydrate rich fruits. It is important in our diet as fibre which helps to maintain a healthy digestive system (USDA National Nutrient Database, 2015). According to Table 1, figure 2 using a biuret method for the protein analysis watermelon has the least value, about 0.70mg/ml, followed by banana with about 1.30mg/ml and highest avocado pear with about 2.25mg/ml which shows that avocado pear is very nutritive in view of the protein content, Minerals, Vitamin C and dietary protein plays a crucial role in both muscle and bone maintenance. According to Table 1, figure 3 which shows the result of vitamin C using DNPH for analysis, watermelon has 8.05mg/ml, banana has 7.20mg/ml and avocado has 8.75mg/ml which has the highest amount of vitamin C. Vitamin C is used as dietary supplement and helps to repair tissue (American society of health system pharmacist, 2016). Also diabetes patient can also benefit from vitamin C as it helps in regulating the sugar levels and hereby reducing the risk of diabetes. The pH values of these fruits are all within acidity range. The pH of fruits is also important as this inform us how these fruits could help to maintain the acid-base balance of our body. The pH value of banana is the lowest 5.10, followed by avocado 5.15, and watermelon which has the highest pH value 6.0.

The Table 2, Figure 2 showed the titrable acidity of watermelon 6.4 which is the highest, avocado/pear 5.22 and banana 5.30. The table 2, figure 3 showed the moisture content of each fruits, watermelon has the highest moisture content of about 92.05, and followed by avocado pear with about 71.05 and the least was banana with about 68.3. It is advisable that people should consume more of watermelon as from the result watermelon contains more moisture needed for our health. The table 2 figure 4 shows ash content of the fruits when viewed in ascending order avocado pear with about 1.2, banana with about 5.60, and the highest watermelon with about 7.00. Fiber is very good in our diet. Fruits with high fiber are highly needed by the body because it aids digestion. Watermelon has the highest fibre about (37.14) according to this work followed by avocado pear (10.86), and the least was banana (8.71). It was observed that avocado in richer in calcium with about 52.0mg, then banana with 24.5mg and also the least watermelon with 10.5mg. In the place of phosphorus, banana has high amount of phosphorus with 42.2mg, phosphorus which is part of the richness of banana, avocado with 35.5mg amount of phosphorus in it and watermelon with 25.02mg. Zinc in watermelon was observed to be 1.84mg/100g, banana has 1.79mg which has the lowest value and avocado with 2.85mg zinc is higher than others. Iron content in watermelon is high with about 3.02mg, and 2.07mg content of iron is found in avocado, lastly banana with 3.0mg. Magnesium content of banana is 70.05mg, in watermelon is 75.02mg which is the highest and in avocado with 72.08mg.

V. CONCLUSION

The results obtained from the study above reveal that fruits are rich in nutrients. These fruits contain nutrients like carbohydrate, protein, vitamin c and minerals such as zinc, phosphorus, magnesium, calcium and iron. They also contain crude fiber, ash content, moisture content and they also have their own pH and acidity. Fruits are therefore recommended as a supplement in diet and should be consumed by those recovering from ailment

Some mineral contents in fruits varies, so fruits should be consumed based on their mineral content and fruits should be well studied to know the ones with the highest level of minerals to improve health and ward off diseases.

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