Original Research Article

Proximate Analysis of Avocado Pear and Green Mango: Evaluation of Macro and Micro-nutrient Content of Peels, Fruit and Seed.

ABSTRACT

This research study is aimed at making a comparative analysis of proximate, sugar and vitamin contents in peels, seed and fruits of avocado pear and green mangoes from Awka metropolies. The proximate compositions (moisture, ash, fat, fiber, protein and carbohydrate), reducing, non-reducing and total sugar were determined using AOAC(ASSOCIATION OF OFFICIAL ANALYTICAL COLLABORATION) method. The concentration of vitamin A and C was determined by titration technique in aqueous extract of EDTA/TCA solution and titrating with $CUSO_4$. The result show that moisture content of 10.10% was recorded for avocado peels and 47.50% for mango fruit, while the proximate analysis carried out recorded ash (3.87-7.35%), fiber (3.22-7.85%), protein (0.62-3.11%), fats (2.27-17.50 and carbohydrates (37.70-65.32%). Total sugar content ranges from 2.1mg/100g in mango seed to 16.80 in avocado fruit. Vitamin A ranged from 0.11mg/100g in avocado peels to 1.80mg/100g in avocado fruits, while vitamin C ranged (10.30-26.40MG/100g), vitamin D (0.83-3.10mg/100g) and vitamin E (4.18-12.74MG/100g). Vitamin A ranged from 0.11mg/100g in avocado peels to 1.80mg/100g in avocado fruits, while vitamin C ranged (10.30-26.40MG/100g), vitamin D (0.83-3.10mg/100g) and vitamin E (4.18-12.74MG/100g).

The result showed that peels, seed and fruits of avocado pear and green mangoes contain enough vitamin C, an antioxidant essential for human health hence the need to increase the consumption of these fruits, thus there is need to increase the consumption of these fruits.

INTRODUCTION

In Africa, fruits and vegetables are an essential part of the diet. The most common fruits eaten in our area are tomato fruits. They are nourishing (high in vitamins and minerals) and necessary for preserving human health.

Mangoes (Mangifera indica L.) are one of the most consumed fruits by millions of people worldwide in numerous nations. Soong et al. (2008) determined that per 100 g of mango, it includes 75 to 82% water, 8.7 to 20% sugar, 0.14 to 0.71% citric acid, 0.38 to 0.63% ash, and 8.5 to 50 mg of vitamin C. Mangifera indica bark extracts have been shown to be beneficial in the treatment of toothaches (Afam-ezeaku et al., 2022).

The avocado pear, or Persea americana Mill., is a polymorphic tree species that has its origins in a large geographic region that stretches from Guatemala to the Pacific, across the eastern and central highlands of Mexico (Athar and Nasir, 2005). Currently, avocados are a fruit that are grown all over the world, particularly in tropical regions. Depending on the kind, avocados come in a range of shapes, sizes, and colors. Avocado fruit, which has a high lipid content, can be eaten straight up as a source of high energy. A good source of oil is also found in avocado fruit (Quinones-Islas et al., 2019).

When fruits are peeled during processing for food and other uses, peels are the basic wastes or byproducts produced. In addition to being fed to animals like goats and sheep (Ekenyem and Madubuike, 2006), they are also used as feed for snails (Omole et al., 2013), broiler chicks (Ekenyem and Madubuike, 2006), and weaner rabbits (Akinmutimi et al., 2006). They are primarily sourced from fruit processing facilities, commercial eateries, and markets. Peels are important in a variety of crops, including cassava. The ability to bioconvert cassava peels to value-added products is demonstrated by the chemical composition of cassava peels, which, when

impacted by isolates, releases reducing sugar and increases protein content (Nwakoby et al., 2022). According to Ijaiya and Awonusi (2005), the avocado pear's peels make up around 10% of the fruit and have been found to have 2 to 6% crude protein and 9 to 15% crude fiber, depending on the variety.

An organism needs a small amount of vitamins, which are organic compounds and essential nutrients. When an organism cannot produce an organic chemical compound in sufficient amounts and must get the molecule through nutrition, the compound is referred to be a vitamin. be a result, the term "vitamin" depends on the situation and the specific organism. For instance, vitamin C (ascorbic acid) is a vitamin for humans but not for the majority of other creatures.

According to Olsen and Heitmann (2009), excessive use of sugar-sweetened beverages raises the risk of becoming overweight, obese, developing heart disease, and developing teeth decay. Due to their high sugar content in the form of fluid, they have high energy levels but frequently do not satisfy hunger like solid foods do (Barminas and Charles, 2008). To improve food security, it is necessary to monitor and regulate all fruits that contain sugar.

In recent years, a great deal of scientific research has been put into providing empirical evidence to support the use of avocado, pears, and green mango peels in food and medicine (Akinmutimi et al., 2006). Globally, scientific validations are being conducted to obtain proof for traditionally renowned herbal plants. However, there are still countless plants with enormous medicinal potential that have yet to be realized. Additionally, it has been demonstrated that sugar-sweetened beverages can cause weight gain in both adults and children and are linked to a number of chronic health issues, such as an increased risk

of obesity, diabetes, cardiovascular disease, and fatty liver disease. Researchers must undertake in-depth dietary analysis looking at the sugar level in the most eaten fruits and beverages because it is unknown how much sugar is actually present in foods.

MATERIALS

The avocado pear and green mangoes were collected from sellers in open markets in Awka. The samples collected were transported in a sterile polyethylene bag to the laboratory for analysis within 24 hours.

METHOD

Preparation of sample

The peels of avocado pear and green mangoes were removed using knife, the peels, fruit and seed (100 g) were blended separately and use for the analysis.

Moisture content determination

The moisture content was calculated using AOAC's (2010) recommended standard procedure. An oven was used to wash and dry a petri dish. The sample was weighed into a petri plate at exactly 2 g. Before drying, the sample and petri dish weight is recorded. The petri dish containing the sample was placed in the oven and baked for 1 hour at 100°C. The results were documented, and the oven was heated for an additional 1 hour to achieve a consistent result before the weight was recorded. Until a constant weight is achieved, the drying process is continued.

W1 - W2 x 100 Wt of sample equals the percentage of moisture content.

where W1 is the weight of the sample and petri dish prior to drying.

W2 is the petri dish's weight.

Ash content determination

Ash content was calculated using AOAC's (2010) recommended standard procedure. Exact 2 g of the wet sample was weighed into the empty platinum crucible after it had been cleaned, dried, and its weight recorded. It was then placed in a muffle furnace at 500°C for three hours. After burning, the sample was cooled in desiccators and weighed.

% Ash content is calculated as W3 - W1 x 100 W2 - W1 1, where W1 is the weight of an empty platinum crucible.

W2 is the sample's and the platinum crucible's combined weight before burning.

W3 = platinum and ash weight

Fiber content determination

The amount of fiber was determined using the AOAC's (2010) recommended technique. Using petroleum ether, defat 2 g of material (if the fat content is greater than 10%). 100 ml of a solution containing 1.25 percent H2SO4 per 100 ml of solution should be boiled under reflux for 30 minutes. Filter the mixture using linen or many layers of cheese cloth on a fluted funnel, then wash the resulting garments in hot water until the acid is removed. Place the leftovers in a beaker and boil for 30 minutes with 100 ml of a 1.25 NaOH per 100 ml solution. In a Gooch crucible, filter the final residue through a thin but dense pad of cleaned and lit asbestos before drying it in an electric oven and weighing it. Incinerate, cool and weigh.

The loss in weight after incineration x 100 is the percentage of crude fiber

$$\% \text{ crude fiber} = \frac{\text{weight of fiber}}{\text{Weight of sample}} \times 100$$

Protein content determination

Protein content was calculated using AOAC's (2010) recommended standard procedure. In order to avoid the sample from hitting the side

walls of each flask, precisely 0.5 g of sample was weighed into a 30 ml kjehdal flask before the flasks were stopped and shaken. The Kjedahl catalyst mixture was then added in a volume of 0.5 g. In a digestion rack over fire, the mixture was slowly heated until a clear solution appeared. After standing for 30 minutes, the clear solution was allowed to cool. After cooling, 50 ml were transferred to the Kjedahl distillation apparatus, and approximately 100 ml of distilled water were added to prevent caking. With the tap being about 20 cm inside the solution, a 100 ml receiver flask containing 5 ml of 2% boric acid and an indicator mixture made up of 5 drops of bromocresol blue and 1 drop of methylene blue is placed under a condenser of a distillation apparatus. The digested sample was added to the device along with 5 ml of 40% sodium hydroxide, and distillation started right away. It continued until 50 drops made it into the receiver flask, at which point it was titrated to a pink color using 0.01 N hydrochloric acid.

Calculations: Titre value x 0.01 x 14 x 100 = % NitrogenProtein weight of sample equals nitrogen weight times 6.25.

Fat content determination

The standard method of AOAC (2010) was used to determine the fat content. Dry 250 ml clean flasks in oven for around 30 minutes at 105 to 110°C. After cooling, transfer into a desiccator. Weigh the cooled, appropriately labeled flasks. Assemble the soxhlet apparatus, add about 300 ml of petroleum ether (boiling point: 60°C) to the flasks, lightly plug the extraction thimble with cotton wool, and let to reflux for about 6 hours. Carefully remove the thimble, collect the petroleum ether in the set-up's top container, and then drain it into another container for later use. Remove flask after petroleum ether was nearly gone, and let it dry

for an hour at 105 to 110 °C. Transfer from the oven into a desiccator and allow cooling and weighing.

$$\% \text{ fat} = \frac{\text{weight of fat}}{\text{Weight of sample}} \times 100$$

Carbohydrate content determination

Carbohydrate content was determined according to the standard method of AOAC (2010).

% Carbohydrate = 100 – (% Protein + % Moisture + % Ash + % Fat + % Fibre)

Determination of Vitamin A

The amount of vitamin A will be calculated using the AOAC (2005) technique. Then, a 5 ml sample will be saponified using a potassium hydroxide alcoholic solution while being exposed to pyrogallol. As a result, any retinyl ester in the food matrix was converted to retinol and the vitamins were liberated. Diethyl ether and petroleum spirit will be used to extract the vitamin A-containing material that has not been saponified. Under nitrogen, the extract will evaporate, and the resulting residue will be dissolved in methanol. A reverse phase octadecyl silane (ODS) column will be used to chromatograph the extract, and the mobile phase will be composed of 95% acetonitrile and 5% water. The separated retinol will be then quantified using a UV absorbance detector at 328 nm Calculate the content of vitamin A in International Units per gram from the expression:

$$\frac{\mathbf{A \times V \times 1900}}{\mathbf{100 \times m}}$$

Determination of Vitamin C

The AOAC (2005) technique will be used to calculate the ascorbic acid. The sample will then be weighed in two milliliters (2ml), and 100 ml of distilled water will be added. After that, it will be filtered to produce a clear solution. Additionally, 10 ml of the transparent solution will be pipette-filled into a tiny flask before 2.5 ml of acetone is added. Then, an indophenol solution (2, 6-dichlorophenolindophenol) titration will be performed until a 15-second pink color is achieved. Vitamin C (mg/100ml of sample) = 20 x V x C will be used to calculate the amount of vitamin C. Where: C = mg of vitamin C per milliliter of indophenols; V = indophenol solution in titration (ml).

$$\text{Vitamin C mg/100} = \frac{20 \times (V1-V2) \times C}{\text{Weight of sample}}$$

DETERMINATION OF SUGAR LEVEL

Principle: This is a measurement of the total soluble solids in juice used in the industry. Sucrose, fructose, and glucose are the main sugars that make up these soluble solids. The juice's minerals and citric acid both add to the soluble solids. Brix, which is stated as "degrees Brix", is the same as %. For instance, 12% of the total soluble solids are present in juice with a Brix level of 12. The minimal brix sugar/acid ratio for navel drink is 7.8, according to national guidelines.

Procedure

1. The measurement will be made using a refractometer.
2. Make sure the surface of the refractometer prism is dry and clean.
3. Add a few drops of fresh juice to the refractometer's prism.

4. While aiming the prism away from the sun and toward a bright area, take a look through the eyepiece.

5. Pay attention and measure the percentage of sugar (°Brix) where the base of the blue color is located on the scale.

6. Immediately wipe down the refractometer with a moist cloth and dry it completely.

RESULT

The result for the proximate compositions, vitamin and sugar contents in peels, seed and fruits of mango and avocado pears are shown in table 1 to 3. Table 1 showed the proximate compositions and from the results, Moisture range from 10.10% in avocado peels to 47.50% in mango fruit, ash (3.87-7.35%), fiber (3.22-7.85%), protein (0.62-3.11%), fats (2.27-17.50 and carbohydrates (37.70-65.32%).

Table 1: Proximate composition of peels, seed and fruits of mango and avocado pears (%)

SAMPLE	MOISTURE	ASH	FIBER	PROTEIN	FATS	CARBOHYDRATE
MANGO FRUIT	47.50± 0.10	6.80± 0.10	3.22± 1.00	2.51± 0.10	2.27± 0.20	37.70± 2.00
MANGO SEED	16.33± 1.20	4.77± 0.12	3.55± 0.30	1.05± 1.01	9.60± 1.10	64.70± 1.00
MANGO PEELS	13.50± 0.00	3.87± 1.10	5.41± 1.05	0.62± 0.31	3.25± 0.60	73.35± 2.10
AVOCADO FRUIT	37.50± 0.10	4.43± 0.15	2.22± 1.20	3.11± 0.15	5.17± 1.10	47.57± 1.00
AVOCADO SEED	11.30± 0.22	7.35± 0.11	4.80± 0.20	2.35± 0.11	17.50± 0.50	56.70± 1.00

AVOCADO PEELS	10.10± 0.20	5.33± 0.00	7.85± 1.00	1.60± 0.10	9.80± 0.10	65.32± 1.00

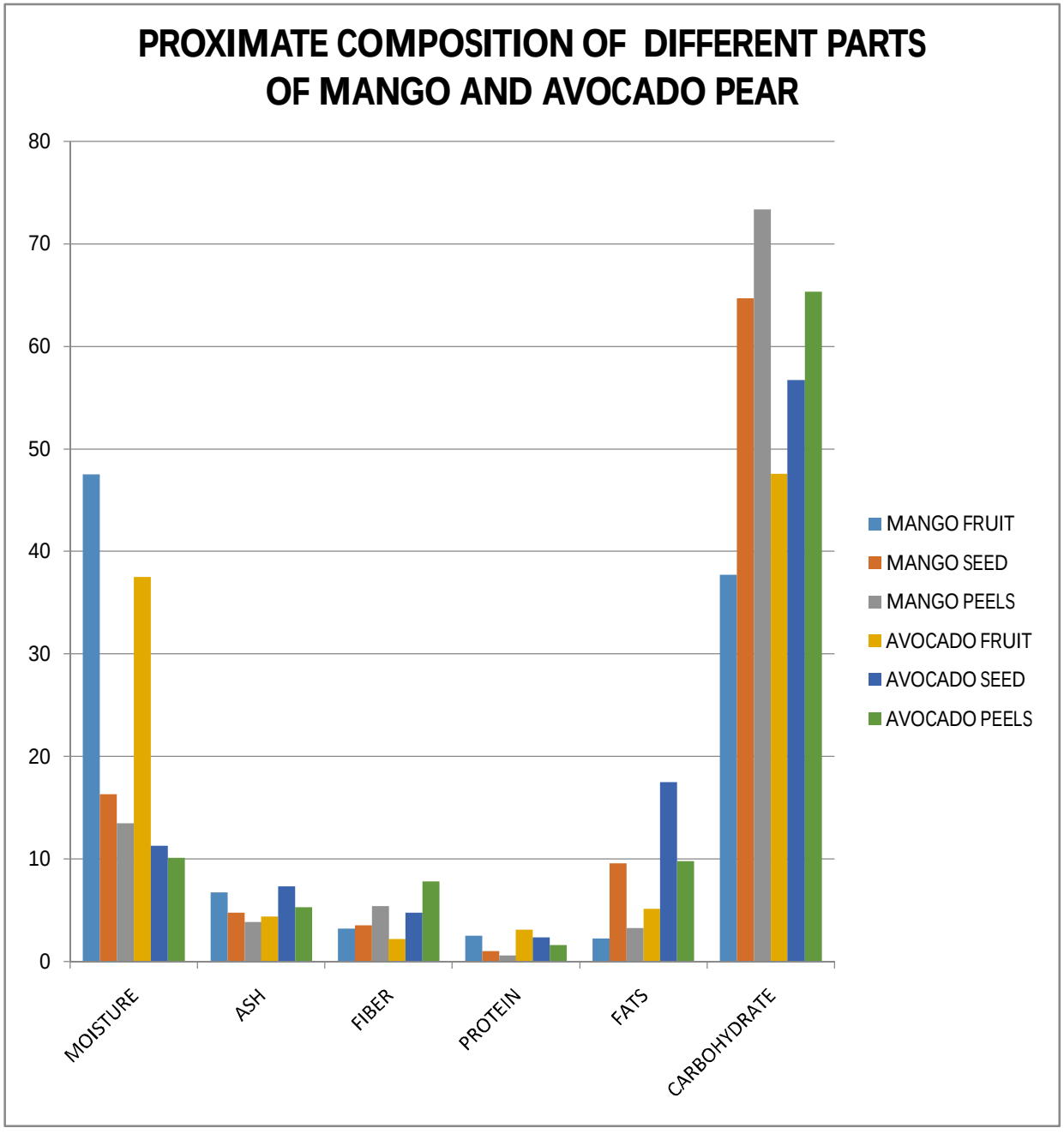

Figure 1: Proximate Composition of different parts of Mango and Avocado Pear

SUGAR COMPOSITION (Mg/100g)

The result of the comparative sugar contents in peels, seed and fruits of avocado pear and green mangoes in Awka metropolies is presented in table 3. The total sugar content range from 2.1mg/100g in mango seed to 16.80 in avocado fruit

Table 2: sugar composition of peels, seed and fruits of mango and avocado pears (mg/100g)

SAMPLE	REDUCING SUGAR	NON REDUCING SUGAR	TOTAL SUGAR
MANGO FRUIT	3.783± 0.15	6.212± 0.13	10.00± 1.00
MANGO SEED	1.043± 0.21	1.139± 0.00	2.182± 0.00
MANGO PEELS	1.57± 0.13	3.45± 0.10	5.03± 0.10
AVOCADO FRUIT	5.78± 0.10	11.22± 0.10	16.80± 0.01
AVOCADO SEED	3.05± 0.11	5.11± 0.13	8.61± 0.20
AVOCADO PEELS	3.00± 0.00	2.19± 0.21	5.20± 0.11

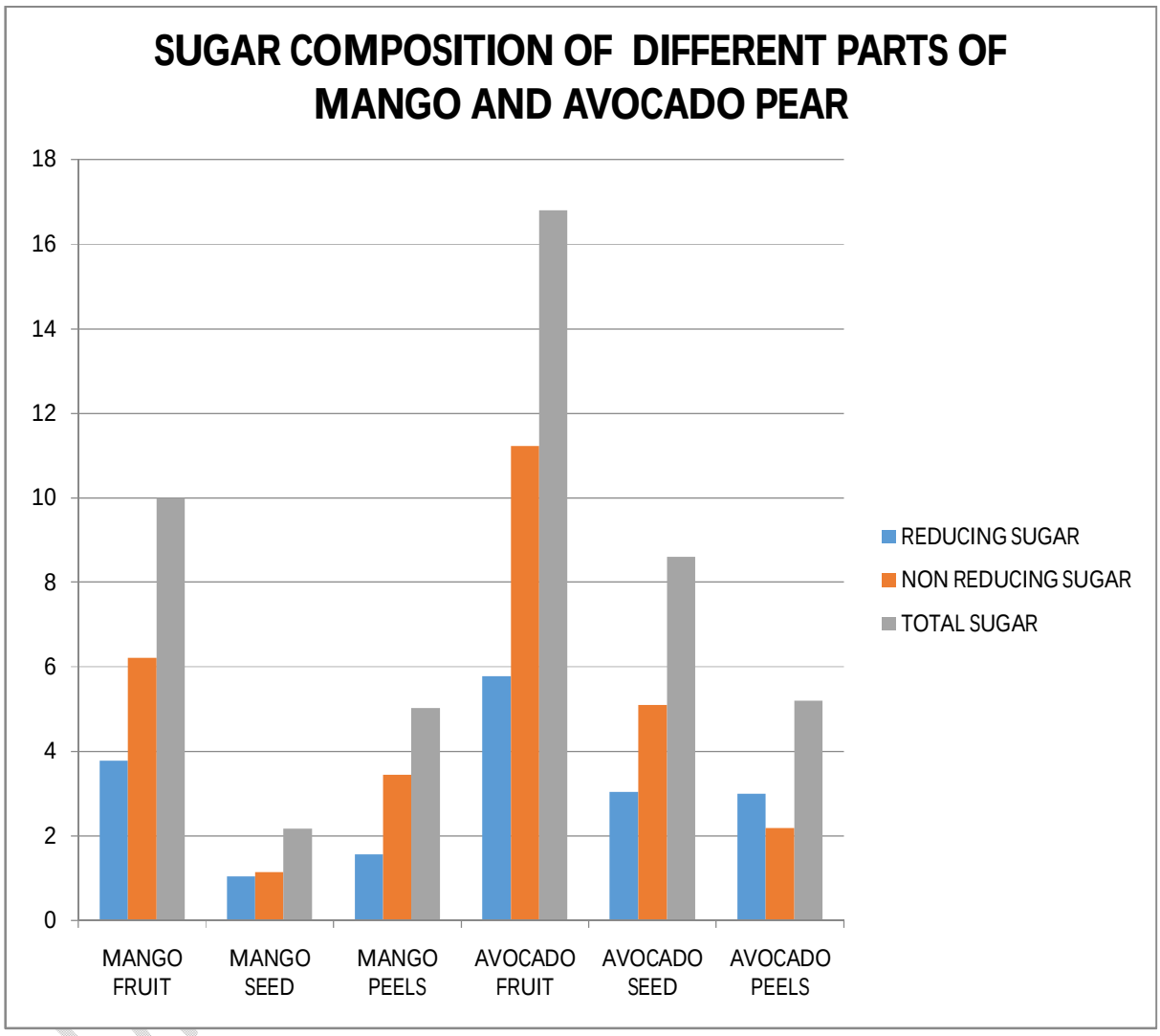

Figure 2: Sugar Composition of Different Parts of Mango and Avocado Pear

VITAMIN COMPOSITION

The result obtained for the vitamin A and C vitamins in peels, seed and fruits of avocado pear and green mangoes are presented in table 3. Vitamin A range from 0.11mg/100g in avocado peels to 1.80mg/100g in avocado fruits, vitamin C (10.30-26.40MG/100g), vitamin D (0.83-3.10mg/100g) and vitamin E (4.18-12.74MG/100g).

Table 3: Vitamin composition of peels, seed and fruits of mango and avocado pears (Mg/100g)

SAMPLE	VITAMIN A	VITAMIN C	VITAMIN D	VITAMIN E
MANGO FRUIT	0.16± 0.21	26.40± 0.11	1.03± 0.51	7.45± 0.11
MANGO SEED	0.33± 0.30	10.30± 0.20	3.10± 0.01	7.37± 0.25
MANGO PEELS	1.58± 0.11	11.45± 0.22	2.55± 0.30	10.55± 1.11
AVOCADO FRUIT	1.80± 0.10	31.68± 0.20	1.97± 1.11	4.18± 1.00
AVOCADO SEED	0.48± 0.11	10.13± 0.25	0.83± 0.01	12.74± 0.22
AVOCADO PEELS	0.11± 0.20	17.09± 0.50	1.22± 0.20	9.77± 0.01

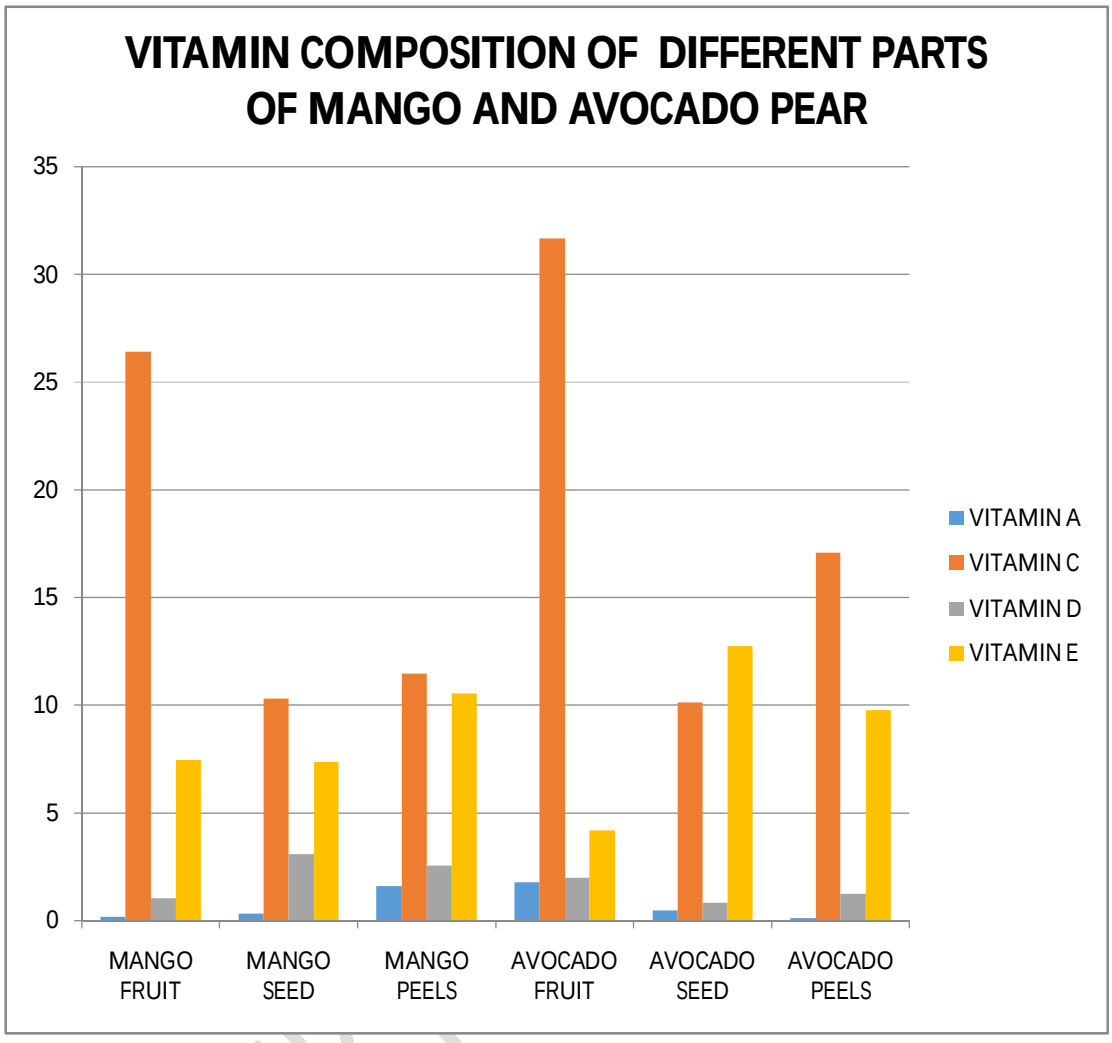

Figure 3: Vitamin Composition of different parts of mango and avocado pear

DISCUSSION

The result from table 1 showed that peels, seed and fruits of avocado pear and green mangoes contain enough vitamin C which is an antioxidant essential for human health. The mango fruits had higher

composition value for Vitamin C than avocado fruits as reported in the study. This is to say that greater quantity of antioxidant vitamins is higher in tomatoe samples with higher supply too, than green pepper (Afam-ezeaku *et al.*, 2021). The Vitamin C composition in the fruit sample compared with the value reported for *Sterculia africana* but lower than the values reported by Okwu and Josiah (2006) for *Aspilia africana* and *Bryophylum pinnatum* .

According to Kadar (2010), vitamin C contents of fruits are influenced by a number of factors and prominent among them include varietal differences and pre-harvest environmental conditions. Any of these factors may have contributed to the variations in the ascorbic acid contents of the samples from that of the stated reports.

This suggests that the sugar concentration of fruit juices appears to represent the true sugar content of the corresponding fresh fruit, in its liquid form. It is relevant to note other beneficial ingredients or nutrients that are found in freshly-extracted fruit juice. The comparison between freshly-extracted and commercial fruit juices has been reported in prior studies.

CONCLUSION

The result showed that the peels, seed and fruits of avocado pear and green mangoes used in this study were better sources for the antioxidant vitamins. The preponderance of these nutrients in the samples, may be of nutritional and physiological importance. They may thus be incorporated

into diets as cheaper and/or more accessible source of nutrients to curtail some nutritional deficiencies.

Moreover, the relatively high antioxidant activities of fruits of avocado pear and green mangoes due to presence of vitamin C indicate the potential health benefits of the fruits. This study rather reports the presence of inherent health beneficial constituents, most of which are associated with the treatment of some chronic diseases.

Also, the peels of avocado pear and green mangoes can significantly supplement the dietary fibre needs of the populace (especially that of urban-dwellers) when incorporated into diets as raw-eaten snacks. The fruit mesocarps may also be used as alternative vitamin A and C sources in solving the challenges associated with the monotony of the traditional commercial ones. In view of the experimental results of the analysis of fruit products it could be concluded that the investigated peels of avocado pear and green mangoes showed high content of vitamin A and C and moderate sugar level. Typical sugar content concentrations in peels, seed and fruits of avocado pear and green mangoes sold within Awka metropolies are shown in Table 2 to serve as a point of reference for the consumers. Fruits are valuable sources of the essential minerals and vitamins. Around sixty different kinds of fruits are available in Awka metropolies. Every human being requires food for their living as well as for the production of necessary energy like all other animals. Different food contains different proportion of carbohydrates. Most of the people are suffering from malnutrition because they are in need of adequate nutritious food.

Fruit is occupying a larger proportion of daily food item of modern civilized nation certainly due to their great food values. Most of the people like fruits very much but in some cases a few of them don’t like

that of unknown cause. The findings indicate that the values for the sugar concentration of sugar in mango was quite high when compared with avocado fruit and seed. This result confirmed the use of mango pulp in wine production when compared with other fruits.

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