COMPARATIVE ANALYSES OF VITAMIN CONTENTS OF AFRICAN PEAR (*DACRYODES EDULIS*) AND AVOCADO PEAR (*PERSEA AMERICANA*)

V.E. Mmuo and A.O. Okoli
Department of Science Laboratory Technology, Federal Polytechnic Oko. Anambra State.

Corresponding author vedforjesus@gmail.com; 08037502579

Abstract

This research was on comparative vitamin content analysis of African pear pulp and Avocado pear pulp. Vitamin A and E contents were determined by colorimetric methods, vitamin C was determined by titrimetric methods and other determinations were conducted using standard analytical techniques. The results obtained from the analyses indicated that African pear pulp and Avocado pear pulp contained vitamins A; (54.842 mg/kg, 43.227 mg/g) respectively, B1 (0.042 mg/kg, 0.082 mg/kg), vitamin B2 (0.058 mg/kg, 0.086 mg/kg), vitamin B3 (0.329mg/kg, 0.317mg/kg), vitamin B5 (2.936 mg/kg, 10.219 mg/kg), vitamin B6 (0.057 mg/kg, 0.037 mg/kg), vitamin B7 (16.619 mg/kg, 14.555 mg/kg), vitamin B9 (2.40 mg/kg, 2.844 mg/kg), vitamin B12 (0.112 mg/kg, 0.125 mg/kg), C (137.377 mg/kg, 222.784 mg/%), D (29.20 mg/kg, 33.60 mg/g), E (31.573 mg/kg, 33.540 mg/g) and vitamin K (13.60 mg/kg, 20.30 mg/g) respectively. The essence of the results is that African pear and Avocado pear had reasonable quantities of vitamin B complex especially vitamins B5 and B7. But Avocado pear pulp was richer.

Keywords: African pear, Avocado pear, vitamins content.

Introduction

Generally, plant parts (seeds, leaves, bark, fruits, and stems) contain bioactive agents with medicinal properties but require proper assessment, including toxicity studies, before possible use as conventional drugs (Egbuonu and Chinazum, 2017). African pear (*Dacryodes edulis*) and the avocado pear (*Persea americana*) are well known plants in Nigeria. Their fruits are gathered for household use or sale in local markets (Ikhuoria and Maliki, 2007). The pulp of the African pear is usually consumed as an accompaniment to fresh maize during the months of April to September. The African pear pulp is first softened in hot water, steam or hot ash before consumption. As at now, there are no preservation methods for the African pear, which is highly perishable, and no processed products have been made from them (Onuegbu and Ihediohanma, 2008). There are different varieties of pear such as *Persea americana, Dacryodes edulis* etc. *Persea americana* and *Dacryodes edulis* are largely consumed by man making it imperative for the nutritional contents to be widely known (Ngozi-Olehi, 2012). The genus *Dacryodes* consists of about 40 species. The common names are (in English) African pear, African pear tree, Bush butter tree, Bush fruit tree, Eben tree, Native pear and, in French, Safoutier (Ajibesin, 2011). The ethanol extract of the stem bark of the African pear gave oil that contained thirteen

compounds including hydrocarbon (l-isopropyl-l-methyl-2-nonylcyclopropane), carboxylic acid (octadecanoic acid), ketone (3-methylheptan-4-one) and an alcohol (6-methylheptan-l-ol) (Okwu and Ighodaro, 2009). The leaves of *Dacryodes edulis* elicited very high antioxidant effect when analyzed against three assay methods: Folin (Folin Ciocalteu Reagent), FRAP (Ferric Reducing Antioxidant Power) and DPPH (1, l-diphenyl-2-picrylhydrazyl), ranking second behind Alchornea cordifolia (Agbor *et al*., 2007). Obasi and Okolie, (1993) reported lack of toxic principles in the seed of African pear plant.

The avocado (Persea americana), a tree likely originated from south-central Mexico is classified as a member of the flowering plant family Lauraceae (Morton, 1987). Avocado slices are frequently added to hamburgers, *tortas*, hot dogs, and *carne asada*. Much of the success of avocados in the UK is attributed to a long-running promotional campaign initiated by South African growers in 1995. Avocados have diverse fats yet they are one of the best foods one can eat. It contains vitamins B1, B2, B3, B5, B6, B9 and vitamins C, E and K. B vitamins are referred to as the energy vitamins and stress fighters. They are particularly concentrated in meat (Stipanuk, 2006). Vitamin B_9 (folic acid) deficiency in early embryo development has been linked to neural tube defects (Art Presser, 2009). Seventy five percent of the high fibre content is insoluble while 25% is soluble (Maitera *et al*., 2014).

Materials and Methods

Reagents: All the chemicals used are of analytical grade

Collection of Sample

Fresh fruits of African pear pulp and Avocado pear pulp were bought at Eke- Oko market in Orumba South Local Government Area, Anambra State.

Sample Preparation

Fresh fruits of African and Avocado pears were washed under running tap water and separated into flesh and seed. The small cut piece of each sample was freeze-dried. The freeze-dried samples were ground into fine powder using a laboratory mortar. The ground samples were sieved to get uniform particle size, then kept in air tight containers and stored in a freezer (-20°C) for analysis.

Vitamin Analysis

The analysis was carried out using Official Methods of Analysis by Association of Analytical Chemists (AOAC, 2005).

Vitamin A (Retinol): One gram of the sample and the standard were mixed with 30mL of absolute alcohol and 3mL of 50mL KOH solution was added to it and boiled gently for 30 minutes under reflux. After washing with distilled water, vitamin A was extracted with 3 X 50mL of diethyl ether. The extract was evaporated to dryness at low temperature and was then dissolved in 10mL of isopropyl alcohol. One millilitre of standard vitamin A solution prepared and that of the dissolved extract were transferred to separate curvettes and their respective absorbances were read in a Thermo Fisher

Scientific spectrophotometer at 325nm with a reagent blank at zero.

Calculation: = $\frac{Absorbance\ of\ Sample \times Concentration\ of\ Standard}{Absorbance\ of\ Standard}$

Vitamin B_1 (Thiamine) and B_2 (Riboflavine): One gram of sample was weighed into a conical flask, the sample was dissolved with 100mL of deionized water, and it was shaken thoroughly and heated for 5 minutes and allowed to cool and filtered. The filtrate was poured into a curvette and their respective wavelengths for the vitamins set to read the absorbance using Thermo Fisher Scientific spectrophotometer.

Vitamin B1 = 261nm, Vitamin B2 = 242nm.

Concentration (mg%) = $\frac{A \times DF \times Volume\ of\ curvette}{5}$. Where A = Absorbance, E = extinction coefficient = 25 for B_1 and B_2, DF = dilution factor

Vitamin B_3 (Niacin): Five gram of the sample was dissolved in 20mL of anhydrous glacial acetic acid and warmed slightly. Five mililitres of acetic anhydride was added and mixed. 2–3 drops of crystal violet solution was added as indicator and 0.1M perchloric acid was added to titrate to a greenish blue colour.

Vitamin B_3 = $\frac{Titre\ value \times 0.0122}{0.1}$

Vitamin B_5 (Pantothiamine): Standard Preparation: The working standard (0.25mL) of vitamin B_5 was taken into 25mL volumetric flask with a solution mixture (chloroform and methanol in ratio of 1:9). It was gently shaken to mix thoroughly and was made up to the mark.

Sample Preparation: The sample (0.25mL) was measured into a 25ml volumetric flask containing a solution mixture (chloroform and methanol in a ratio of 1:9). It was gently shaken to mix thoroughly and absorbances recorded at 246nm against the blank.

Vitamin B_6: Five gram of the sample was dissolved in a mixture of 5mL of anhydrous glacial acetic acid and 6mL of mercury (II) acetate solution. Two drops of crystal violet was added as indicator and 0.1M perchloric acid was used to titrate to green colour end point. Calculation: each mL of 0.1M perchloric acid is equivalent to 0.02056g of $C_8H_{11}NO_3$ HCl.

Vitamin B_7 (Biotin): Sample Preparation: The sample (0.1mL) was taken into a separator. In the separator, 5mL of water was added, mixed well and added 5mL chloroform. The chloroform layer was discarded and the water layer was taken into 50mL volumetric flask by passing it through anhydrous sodium sulphate and made up to 50mL with water. Sample and blank solutions (2ml) were taken into test tubes. In

each test tube, 2mL of 0.2% solution of phenylhydrazine (in hydrochloric acid and alcohol in ratio of 1.5v/v) was added and mixed well. After, it was heated on a water bath until it almost dried and cooled at room temperature. Two mililitres of the solution mixture (ammonia and alcohol in ratio of 1:1) was added in each test tube and 1mL pyridine was added. Absorbance was recorded at 548nm against the blank. Standard cobalamine was also treated and analyzed same as the sample.

Vitamin B_9 (Folic acid): The sample (0.2 milliliters) was weighed and taken into separator. Five milliliters of water was added and mixed well and 5ml of chloroform was used to extract the sample. The water was discarded and chloroform was taken in dry 50ml volumetric flask by passing it through anhydrous sodium sulphate and was made up to 50mL with chloroform. The sample and the blank solutions were each put into separate test tubes. Two milliliters of 0.2% solution of phenylhydrazine (in hydrochloric acid and alcohol in ratio of 1.5v/v) was added in each of the test tubes and were well mixed. They were then each heated on water bath until almost dryness and cooled at room temperature. Fifteen milliliters solution mixture (ammonia and alcohol in ratio of 1:1) each was added in each of the test tubes. Its absorbances was recorded at 635nm against blank.

Vitamin B_{12} (Cobalamine): Twenty five milligram of sample was dissolved in 250mL of deionized water.
The absorbance was read at 361nm.

Calculation: Concentration (mg%) = $\frac{A \times DF \times Volume\ of\ curvette}{E}$
Where A =Absorbance, E = Extinction coefficient =25, DF = dilution factor =5

Vitamin D and K: Total vitamin D and K were estimated by the method described by AOAC, (2005). The experiment was carried out in the dark to avoid photolysis of vitamin D once the saponification was completed. The sample (0.5g) was homogenized and saponified with 2.5mL of alcoholic potassium hydroxide in a water bath at 60^0C for 30 minutes. The saponified extract was transferred to a separating funnel containing 10-15mL of petroleum ether and mixed well. The lower aqueous layer was then transferred to another separating funnel and the upper petroleum ether layer containing the carotenoids was then collected. The extraction was repeated until the aqueous layer became colourless. A small amount of anhydrous sodium sulphate was added to the petroleum ether extract to remove excess moisture. The final volume of the petroleum ether extract was noted. The absorbance of the yellow colour was read in a Thermo Fisher Scientific spectrophotometer at 450nm and 503nm respectively for vitamin D and K using petroleum ether as blank. The amounts of the total vitamin D and K were calculated thus:

Amount of total Vitamin D = $\frac{\text{A450} \times Volume\ of\ Sample \times 100 \times 4}{Weigt\ of\ Sample}$

Amount of total Vitamin K = $\frac{\text{A503} \times Volume\ of\ Sample \times 100 \times 4}{Weigt\ of\ the\ Sample}$

Vitamin E (Tocopherol): According to AOAC, (2005), one gram of the sample was mixed with 10mL of ethanoic sulphuric acid and boiled gently under reflux for 30mins. It was transferred to a separating funnel and treated with 30ml diethyl ether for three times and recovering ether layer each time. The ether extract was transferred to a dessicator and dried for 30mins and later evaporated to dryness at room temperature. The dried extract was dissolved in 10mL of pure ethanol. One mililter of the dissolved extract and equal volume of standard vitamin E were transferred to separate tubes. After continuous addition of 5mL of absolute alcohol and 1mL of conc. nitric acid solution, the mixtures were allowed to stand for 5mins and the respective absorbance measured in a Thermo Fisher Scientific spectrometer at 410nm with blank reagent at zero.

Results and Discussion

The results of the vitamin contents analyses of Africa pear and Avocado pear are presented in Tables 1 and 2.

In Tables 1 and 2, it is evident that Avocado pear fruit contains more vitamin B complexes, and vitamins A, C, D and E than African pear fruit except vitamins B_7 and A.

Table 1: Results showing the vitamin B complex analysis of African pear and Avocado pear

Vitamin B complex (mg/kg)	African Pear Fruit	Avocado Pear Fruit
B_1	0.042±0.10	0.082±0.13
B_2	0.058±0.33	0.086±0.01
B_3	0.329±0.21	0.317±0.07
B_5	2.936±0.07	10.219±0.02
B_6	0.057±0.46	0.037±0.01
B_7	16.619±0.33	14.555±0.22
B_9	2.40±0.19	2.844±0.21
B_{12}	0.112±0.07	0.125±0.11

Values are mean ± Standard deviations of double determinations.

The results of the study shown in Table 1 revealed the vitamin B-complex content of African pear fruit and Avocado pear fruit. It showed that the vitamin B_1 content of African pear fruit was 0.042± mg/kg, vitamin B_2; 0.58± 0.33 mg/kg, vitamin B_3; 0.329± 0.21 mg/kg, vitamin B_5; 2.936± 0.07 mg/kg, vitamin B_6; 0.057± 0.46 mg/kg, vitamin B_7; 16.619± 0.33 mg/kg, vitamin B_9; 2.40± 0.19 mg/kg and vitamin B_{12} was 0.112± 0.07

mg/kg. Adepoju *et al*, (2016) obtained 0.12 mg of vitamin B_2 and 0.37 mg of B_3, and these values were in line with the results of the analysis. Also, 0.26-0.95 mg/100g of vitamin B_1, 0.23-1.69 mg/100g of vitamin B_2, and 0.17-0.93 mg/100g of vitamin B_3 were obtained in the analysis of African pear fruit by Duru *et al*, (2012). The values by Duru *et al*, (2012) were in tandem with what was gotten from this analysis. African pear fruit is a pregnancy super fruit. It contains natural folic acid which helps to prevent deficiencies in baby's brain and spinal cord. It is rich in sugars, carbohydrates, fibre, vitamins B_1, B_2, B_3, B_6 and B_9, (Health Benefits of African Pear 2, 2019). The results of the vitamin B complex analyses of Avocado pear fruit showed that vitamin B_1 was 0.082± 0.13 mg/kg, vitamin B_2; 0.086± 0.01 mg/kg, vitamin B_3; 0.317± 0.07 mg/kg, vitamin B_5; 10.219± 0.02 mg/kg, vitamin B_6; 0.037± 0.01 mg/kg, vitamin B_7; 14.555± 0.22 mg/kg, vitamin B_9; 2.844± 0.21 mg/kg and vitamin B_{12} was 0.125± 0.11 mg/kg. In his analysis of Avocado pear fruit, Ikennna, (2020), obtained 0.1 mg of vitamin B_2, 1.3 mg of vitamin B_3, 1.0 mg of vitamin B_5, 0.2 mg of vitamin B_6 and 60 mg of vitamin B_9. Atli, (2020), obtained 0.07 mg of vitamin B_1, 0.13 mg of vitamin B_2, 1.74 mg of vitamin B_3, 1.39 mg of vitamin B_5, 0.26 mg of vitamin B_6, 81.0mcg of vitamin B_9 and 0mcg of vitamin B_{12}. Also, in a 230g of mashed Avocado pear fruit, the vitamin B complexes were B_1 ; 0.154 mg, B_2 ; 0.299 mg, B_3 ; 3.997mg, B_6 ; 0.591 mg, B_9 ; 186.30mcg, and B_{12} ; 0.00mcg, (USDA, 2022). According to NHANES analysis, the average consumption of one half of an Avocado pear fruit (68g) provides: vitamin B_2; 0.1 mg, vitamin B_3; 1.3 mg, vitamin B_5 ; 1.0 mg, vitamin B_6 ; 0.2 mg and vitamin B_9 ; 60 mg, (Mark, *et al*, 2013). In a work by Rachael (2022), it was stated that 136 mg of raw Avocado pear fruit contains 0.1 mg of vitamin B_1, 0.2 mg of vitamin B_2, 2.6 mg of vitamin B_3, 2.0 mg of vitamin B_5, 0.4 mg of vitamin B_6, and 121 mcg of vitamin B_9. But comparatively, from the results of the analyses, Avocado pear fruit contained more vitamin B complexes except vitamin B_7.

Table 2: The results of vitamin A, C, D, E and K Content of African Pear Fruit and Avocado Pear

Vitamins	African Pear Fruit (mg/kg)	Avocado Pear Fruit (mg/kg)
A	54.842±0.07	43.227±0.01
C	137.377±0.01	222.784±0.02 (mg/%)
D	29.200±0.02	33.600±0.06
E	31.573±0.19	33.540±0.17
K	13.600±0.11	20.300±0.10

The results from the determination of the vitamin content of African pear fruit and Avocado pear fruit, presented in Table 2 showed that African pear fruit is rich in vitamin A (54.842± 0.07 mg/kg), C (137.377± 0.01 mg/kg), D (29.20± 0.02

mg/kg), E (31.573± 0.19 mg/kg) and K (13.600.11 mg/kg). Adepoju, (2016), obtained 13.45 mg of vitamin C while Duru *et al,* (2012), stated 0.07-0.02 mg/100g and 0.29-0.46 mg/100g of vitamins C and E in the analysis of African pear fruit. These values are at variance with what was obtained in the analyses, this may be as a result of environmental factors. The results in Table 2 indicated that Avocado fruit contains vitamin A (43.227± 0.01 mg/kg), C (222.784± 0.02 mg/kg), D (33.60± 0.06 mg/kg), E (33.540± 0.17 mg/kg) and K (20.300± 0.10 mg/kg). Ikenna, (2020), reported 43µg of vitamin A, 6.0mg of vitamin C and 14 µg in his findings. Atli, (2020), in his own analysis stated that Avocado pear fruit contained 7 mcg of vitamin A, 10 mg of vitamin C, 0 mcg of vitamin D, 2.07 mg of vitamin E and 21 mcg of vitamin K. Also, stated in a report by USDA, (2022), it was observed that 230 g of mashed Avocado fruit contains 16.0 mg of vitamin A, 23.0 mg of vitamin C, 0.00 mg mcg of vitamin D, 0.00 mg of vitamin E and 48.3 mcg of vitamin K. More so, according to NHANES analysis, the average consumption of one half of an Avocado pear fruit (68g) will provide the system with 43µg of vitamin A, 6.0 mg of vitamin C, and 1.3 mg of vitamin E. Rachael, (2022), also reported that 136 g of raw Avocado pear fruit contains 200IU of vitamin A, 12.0 mg of vitamin C, 2.7 mg of vitamin E and 28.6 mcg of vitamin K. However, reports by these researches have shown that many variables could contribute to different amount of these vitamins that are contained in the Avocado pear fruit. These ranges from environmental, maturities to the storage of the fruit. But, the fruits analyzed contained reasonable amount of these vitamins which is an indication that African pear and avocado pear are good sources of vitamin.

Conclusion

From the results, African pear and avocado pear fruits contain a lot of vitamins which play important roles in providing and protecting the body from diseases. Worthy to note is that Avocado pear fruit contains more vitamin B complexes, and vitamins A, C, D and E than African pear fruit except vitamins B_7 and A. These vitamins could be extracted and used as supplementary vitamins instead of consuming synthetic vitamins A, B complex, C, D, E and K. Those who may have need for these vitamins should eat reasonable quantities of these pear in order to have full benefits of these vitamins.

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