Comparative Studies of Elemental Composition of Ripe and Unripe Avocado Pear (*Percea Americana*) Seeds

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***Abstract* - Ripe and unripe avocado pear (*Percea americana*) seeds obtained from Ekpoma, Edo State were analysed for elemental compositions. Dry digestion was employed for the elemental analysis. The elemental compositions of the analysed ripe *Percea americana* seed include; Na (2.910 mg/kg), K (37.71 mg/kg), Fe (0.092 mg/kg), Ca (1.630 mg/kg), Mg (0.380 mg/kg), Zn (0.142 mg/kg), Cu (0.583 mg/kg) and Mn (0.024 mg/kg), while Na (1.220 mg/kg), K (24.12 mg/kg), Fe (0.096 mg/kg), Ca (1.220 mg/kg), Mg (0.290 mg/kg), Zn (0.109 mg/kg), Cu (0.411 mg/kg) and Mn (0.018 mg/kg) were determined for the unripe *Percea americana* seed. The concentrations of the various elements indicates that the seeds of *Percea Americana* can be utilize for many industrial applications in the areas of food/feed formulation, pharmaceutical, etc.**

Keywords: Concentration, element, *Percea americana*, pharmaceutical and seed.

I. INTRODUCTION

Minerals are inorganic compounds found in all biological tissues and fluids, and their presence is required for the proper functioning of certain physicochemical processes (Soetan, Olaiya & Oyewole, 2010). Minerals are chemical components that the body uses in a variety of ways. Despite the fact that they produce no energy, they serve a crucial role in a variety of bodily functions (Eruvbetine, 2003). For their normal life activities, all forms of biological things require certain inorganic elements or minerals (Ozcan, 2003). Minerals are divided into macro (major) and micro (trace) elements. The ultra-trace elements are the third group (Soetan *et al*., 2010). Calcium, phosphorus, sodium, and chloride are macrominerals, while iron, copper, cobalt, potassium, magnesium, iodine, zinc, manganese, molybdenum, fluoride, chromium, selenium, and sulfur are microminerals (Eruvbetine, 2003).

The macro-minerals must be in concentrations larger than 100 mg/dl, whereas the micro-minerals must be in concentrations less than 100 mg/dl (Murray, Granner, Mayes & Rodwell, 2000). Boron, silicon, arsenic, and nickel are ultra-trace elements that have been detected in animals and are thought to be important for them. The evidence concerning the requirements and importance of other elements such as cadmium, lead, tin, lithium, and vanadium is inconclusive (Albion Research Notes, 1996). Biological test methods emphasized the significance and value of mineral elements for human

and animal nutrition in this century, and advanced analytical techniques led to the identification of trace elements as necessary nutrients, which is still a hot topic of research today. Micronutrient deficiency is a major public health issue in many poor nations, particularly among newborns and pregnant women (Batra and Seth, 2002). Infants require additional attention since they require appropriate micronutrients for normal growth and development (Rush, 2002). Iron deficiency, which causes varying degrees of impairment in cognitive performance, lowered work capacity, lowered immunity to infections, pregnancy complications such as low birth weight babies, poor learning capacity, and reduced psychomotor skills, is the most serious micronutrient deficiency (Batra and Seth, 2002).

Mineral element determination in plants is critical since the concentration and kind of minerals affect the quality of many foods and medications (Bahadur *et al*., 2011). In this approach, not only must the absolute quantity of minerals in edible sections of foods be assessed, but these minerals must also be in bioavailable forms for the organism. Scientists and nutritionists have begun to believe in the therapeutic role of metals in human health in recent years (Udayakumar and Begum, 2004).

Plant parts (seeds, leaves, bark, fruits, and stems) generally include bioactive compounds with therapeutic characteristics, but they must be thoroughly evaluated, including toxicity studies, before being used as conventional medications in animals, including humans (Egbuonu and Opara, 2017). For avocado processors, the seed is now an underutilized resource and a waste issue. In the majority of countries, the avocado seed is discarded. This garbage could be harmful to the environment or people. Data on its elemental and chemical composition, on the other hand, could qualify it for use in food or animal feed. Avocado (*Persea americana*) is a plant that belongs to the Lauraceae family and genus. The plant is native to Mexico, although it may thrive in tropical climates such as Nigeria (Leite, Brito & Cordeiro, 2009). Avocado, also known as alligator pear in Jamaica, refers to the tree's fruit, which is a huge berry with a solitary seed in the center (California Avocado Society yearbook). Depending on the variety, the fruit can be pear-shaped, egg-shaped, or spherical, with a length of 7-20cm and a weight of 100-1000g. It has a core seed that is 5-6.4cm long. Avocados, like bananas, are a climatic fruit. That is to say, it matures on the tree but ripens away from it. The tree can grow to a height of about 20m. It has alternately arranged 12-25cm long leaves and little greenish-yellow blooms that are 5-10mm wide.

Fig 1. Avocado fruits

Fig 2. Avocado seeds

Avocados have an olive-green peel and a thick pale yellow pulp high in fatty acids including linoleic, oleic, palmitic, stearic, linolenic, capric, and myristic acids. This fruit is typically consumed by humans, but it has also been utilized as a medicinal herb in Mexico and other parts of the world (Dreher and Davenport, 2013). The avocado seed represents 13-18 percent of the fruit, and it is a byproduct generally not utilized. Typically, the seed is discarded during pulp processing. The mineral components of ripe and unripe avocado seeds were examined in this study.

II. ANALYTICAL STUDY

Samples were carefully handled to avoid contamination. All glassware used was soaked in 1M nitric acid for 48h and rinsed with deionized water. All the reagents used were of analytical grades.

2.1 SAMPLE COLLECTION AND PREPARATION

Samples of matured avocado pear (*P. americana*) was purchased from New market, Ekpoma, Edo state Nigeria. Sample was prepared as reported by Ejiofor *et al*., (2018).The purchased fruit was divided into two parts with one part allowed to ripen (soften). The fleshy (pulp) part of the fruit of the unripe avocado was removed to obtain the seed. The seeds were minced by means of a grater and dried in an oven at 105 ^{O}C. It was then pulverized with electrical blender to powder and then stored in a container. Same procedure was repeated for the ripe avocado pear seed.

2.2 ASHING FOR MINERAL ESTIMATION

Ash represents the inorganic part of the plant. The composition of ash depends on part of the plant material. The minerals were analyzed by dry ashing the samples at 550^{o}C to constant weight and dissolving the ash in volumetric flask (100ml) using distilled, deionized water with 4ml of concentrated hydrochloric acid. The aliquot was used for the estimation of elements in ash solution.

2.3 MINERAL ANALYSIS

Mineral analysis was carried out following various standards methods of analysis (Ademoroti, 1996). Zinc (Zn) Calcium (Ca), Magnesium (Mg), was determined by complexiometric titration. Sodium (Na) and Potassium (K) were determined using flame photometer (Model, 405, Corning, UK), Iron (Fe) was determined using UV/Visible spectrophotometric method while Manganese (Mn) and Copper (Cu) elements were determined by the method of atomic absorption spectrophotometry (AAS) using a buck atomic absorption/emission spectrophotometer (Model 210VGB) with air-acetylene flame, coupled to a recorder and using the appropriate hollow cathode lamp.

III. RESULTS AND DISCUSSIONS

Table 1 shows the result obtained for the elemental analysis of ripe and unripe avocado (*Persea americana*) seeds.

Table 1: Elemental analysis of *Persea americana* seed

S/N	Parameter	Ripe seeds (mg/kg)	Unripe seeds (mg/kg)
1	Ca	1.630±0.11	1.220±0.01
2	Mg	0.380±0.31	0.290±0.02
3	Na	2.910±0.02	1.845±0.13

4	K	37.71±0.22	24.12±0.01
5	Zn	0.142±0.32	0.109±0.02
6	Fe	0.092±0.12	0.096±0.22
7	Mn	0.024±0.21	0.018±0.11
8	Cu	0.583±0.10	0.411±0.10

Values are in mean ± S.D

Avocado pear seed (*Persea americana*), obtained after consuming the avocado fruit flesh and usually discarded as waste could contain important minerals and be useful in supplementing essential mineral deficiency. Manganese was recorded as the least mineral with 0.024±0.21 mg/kg and 0.018±0.11 mg/kg for the ripe and unripe avocado pear seed. The concentration of sodium in avocado pear seed was 2.910±0.02 mg/kg and 1.845±0.13 mg/kg for the ripe and unripe seeds respective. The dietary allowance for sodium is 110mg - 3300mg for adults (National Research Council (US), 1989). The Adequate Intake for sodium is 1.2 to 1.5 grams per day the minimum amount that promotes hypertension (Geleijnse, Kok, & Grobbee, 2004).

The concentration of potassium on the other hand was found to be highest 37.71±0.22 mg/kg and 24.12±0.01 mg/kg for ripe and unripe avocado pear seeds respectively for all elements determined in both samples. This was in agreement with that reported by Egbuonu *et al*. (2017), which is not far from the dietary allowance for potassium (1875 mg - 5625 mg) for adults (National Research Council (US), 1989). Potassium is essential in the human body. Along with sodium, it regulates the water balance and the acid-base balance in the blood and tissues. Potassium is necessary for normal growth and muscle development. Low potassium diets increase the risk of hypertension, stroke, and cardiovascular disease (Aburto *et al*., 2013).

The magnesium content of the ripe seeds was found to be 0.380±0.31 mg/kg and 0.290±0.02 mg/kg for the unripe seeds. Magnesium aids in the maintenance of normal nerve and muscle function, the maintenance of a healthy immune system, the regulation of the heartbeat, and the maintenance of strong bones. It also aids in the production of energy and protein by regulating blood glucose levels.

Zinc is required for the body's defensive (immune) system to function properly. It is involved in cell division, cell growth, wound healing, and carbohydrate breakdown and has been estimated to be 0.142±0.32 mg/kg in ripe avocado pear seeds and 0.109±0.02 mg/kg in unripe avocado pear seeds.

The calcium content of avocado seeds was 1.630±0.11 mg/kg for ripe avocado seeds and 1.220±0.01 mg/kg for unripe avocado seeds. Egbuonu *et al*. (2017) reported 0.064 mg/kg for avocado pear seeds. For a 70kg man, the dietary allowance for calcium is 800mg (National Research Council, 1989). Calcium works with magnesium, manganese, phosphorus, vitamins A, C, and D, and protein to form strong bones. Calcium is required for blood vessel contraction, muscle contraction, and certain

enzymes in metabolic processes. Calcium is one of the minerals thought to play an important role in fruit storage quality (Igwenyi *et al*., 2014).

Iron content in both sample recorded 0.092±0.12 and 0.096±0.22 mg/kg for the ripe and unripe avocado seeds respectively. The dietary allowance for iron is 10g for 70kg (National Research Council (US), 1989); therefore, avocado could be recommended as a dietary supplement for people who need iron.

Copper was estimated to be 0.583±0.10 mg/kg for ripe avocado seeds and 0.411±0.10 mg/kg for unripe avocado seeds. Copper is incorporated into a variety of proteins and metalloenzymes that perform essential metabolic functions; the micronutrient is required for proper bone, connective tissue, brain, heart, and many other body organ growth, development, and maintenance. Copper collaborates with iron to assist the body in the formation of red blood cells. It also aids in the health of the blood vessels, nerves, immune system, and bones. The recommended daily allowance ranges from 200 to 900 micrograms per day (Trumbo, Yates, Schlicker & Poos, 2001).

IV. CONCLUSION

The present investigation revealed that avocado pear seeds could serves as useful dietary supplements as it contains these essential minerals which are needed for the proper functioning of the human body and also plant development.

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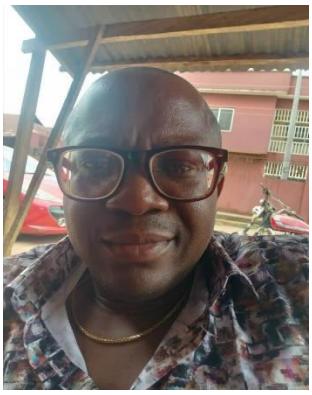

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