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# Comparative Chemical Analyses of the Leaves and Seeds of *Persea americana*

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## ABSTRACT

The present study evaluated and compared the chemical compositions of the leaves and seeds of *Persea americana*. Chemical analyses of the extracts were done using standard methods. Tannins, flavonoids, alkaloids, glycosides, terpenoids, saponins and steroids were present in the leaf and seed samples. Flavonoid, terpenoid and glycoside concentrations were significantly ($P<0.05$) higher in the leaves while alkaloids, saponins, tannins and steroids did not differ in both extracts. Percentage carbohydrate was significantly ($P<0.05$) higher in the seeds while the leaves had higher percentage protein and crude fat. No significant ($P>0.05$) difference in percentage moisture, fibre and ash were recorded in both samples. Thiamin, riboflavin, pyridoxine, cyanocobalamine, ascorbic acid, ergocalciferol and tocopherol were significantly ($P<0.05$) higher in the seeds while the leaves contained significantly ($P<0.05$) higher concentration of retinol. The concentrations of niacin and biotin were not significantly different in the leaf and seed samples. The leaves contained significantly ($P<0.05$) higher amounts of iron (Fe), zinc (Zn) and phosphorus (P). The seeds recorded significantly ($P<0.05$) higher amount of potassium (K) while the concentrations of calcium (Ca), magnesium (Mg), sodium (Na), and copper (Cu) did not differ significantly ($P>0.05$) in the leaves and seeds. Lead (Pb) was not detected in both samples. The study shows that the leaves and seeds of *Persea americana* could be medicinally and nutritionally useful due to their rich phytochemical, proximate, vitamin and mineral compositions.

Key words: *Persea americana,* Leaves, Seeds, Chemical Analysis

## INTRODUCTION

Healthcare has become way of life of people and is now being professionalized in modern societies. Tropical herbs make up important components of the traditional healthcare system as they contain many medicinally relevant compounds that serve as well nutritive purposes [1]. Though the rural users of plants lack scientific explanations, there is a great awareness in the use and significance of these medicinal and nutritional floras by the World Health Organization in several resource-poor nations like Nigeria [2]. The world's attention has once again turned to the traditional medical system and as such it is scientifically imperative to establish a balanced correlation between chemical, biological and therapeutic activities of medicinal and nutritive flora which are precursors for most conventional drugs and food supplements [3]. Plants have great importance due to their nutritive value and continue to be major sources of medicines as they have been found throughout human history [1].

Analysis of edible fruit and vegetables plays a crucial role in assessing their nutritional significance. As various medicinal plant species are also used as food along with their medicinal benefits, evaluating their nutritional significance can help to understand the worth of these plant species [4]. Each medicinal plant species has its own nutrient composition besides having pharmacologically important phytochemicals. These nutrients are essential for the physiological functions of human body. Such nutrients and biochemicals like carbohydrates, fats and proteins play important roles in satisfying human needs for energy and life processes [5]. Fortunately, chemical composition diversity in plants also includes many compounds that are beneficial to humans: vitamins, nutrients, antioxidants, anticarcinogens and many other compounds with medicinal value [5].

*Persea Americana* (avocado) is a tropical, evergreen tree in the Lauraceae (laurel family). It originated in Central America but is now cultivated in tropical and semitropical areas worldwide for its oil-rich fruits. It has been used by humans for at least 8,000 years [6].The avocado tree typically grows 9 or 10 m (28 to 32 ft) tall, but may grow to 18 m (60 ft) or more, with a trunk 30 to 60 cm (12 to 24 in) in diameter. The leaves are thick, glossy, dark green above and paler below, and are briefly shed around the time of flowering. Leaf shape is variable, ranging from oval to elliptical to lanceolate, with a bluntly pointed tip (acute) or acuminate; the leaves may be anywhere from 7.5 to 40 cm long. The small yellowish to greenish insect-pollinated flowers are borne in many-flowered clusters either terminal or near the branch tips. The fruits are pear-shaped, oval, or nearly globe-shaped, 7.5 to 33 cm long and up to 15 cm wide, with a tough, leathery rind that at maturity ranges in color from yellow-green to dark green to purple to almost black, and may be smooth or pebbly in texture. The flesh is creamy smooth, sometimes pale to golden yellow or green, enclosing a single large round to conical seed, 5 to 6.4 cm long [6].

The seeds of *Persea americana* are often discarded after eating the flesh and the leaves are also allowed to wither and waste away without considering the possibility of the two plant organs having another possible utility. It is therefore necessary to evaluate the chemical profile of the plant leaves and seeds with a view to establishing possible medicinal or nutritive roles.

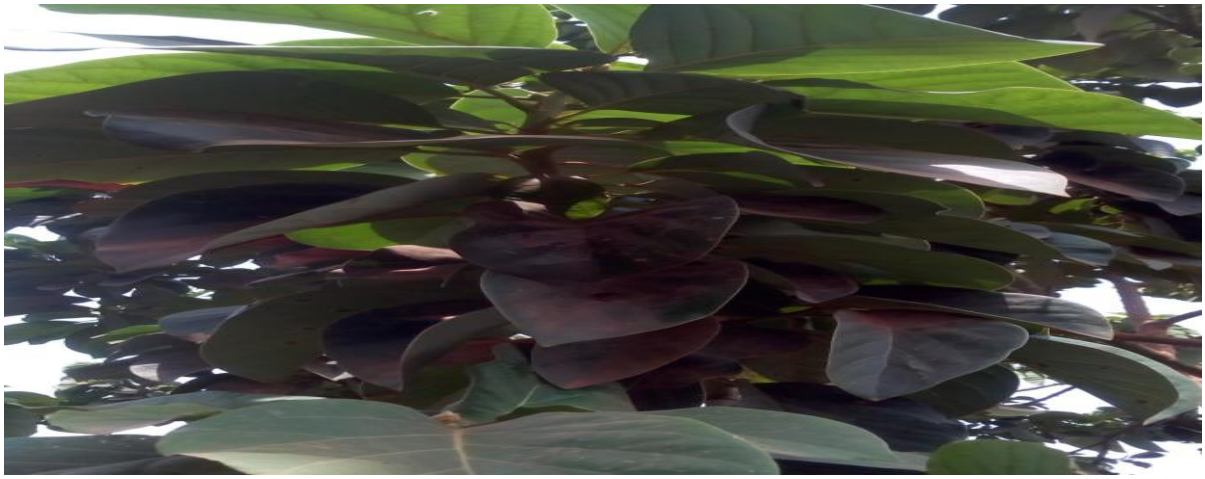

**Plate 1.** *Persea americana* plant showing the leaves

## MATERIALS AND METHODS

### Materials

The fresh leaves and seeds of *Persea americana* were plucked from same plant in Ngbo, Ohaukwu government area of Ebonyi State, Nigeria in the month of January.

### Methods

The methods of [7] were adopted to assay the quantitative phytochemical analyses. The method of [8] was used to assay the total saponin contents. Tannin concentrations were determined according to the method of [9]. The proximate compositions of the plant samples were done using the method of Association of Official Analytical Chemists [10]. The mineral compositions (Ca, K, Mg, Na, Fe, Zn, Cu, Pb and P) of the samples were determined using atomic absorption spectrophotometer. Retinol, thiamin, riboflavin, niacin, pyridoxine, biotin, cyanocobalmin, ascorbic acid, ergocalciferol and tocopherol concentrations were done using the methods of [11] and [12]. Data generated were expressed as mean $\pm$SD for the two samples and subjected to one way analysis of variance (ANOVA) followed by Dunnett's multiple comparison test (DMCT). P values < 0.05 were considered statistically significant.

## RESULTS

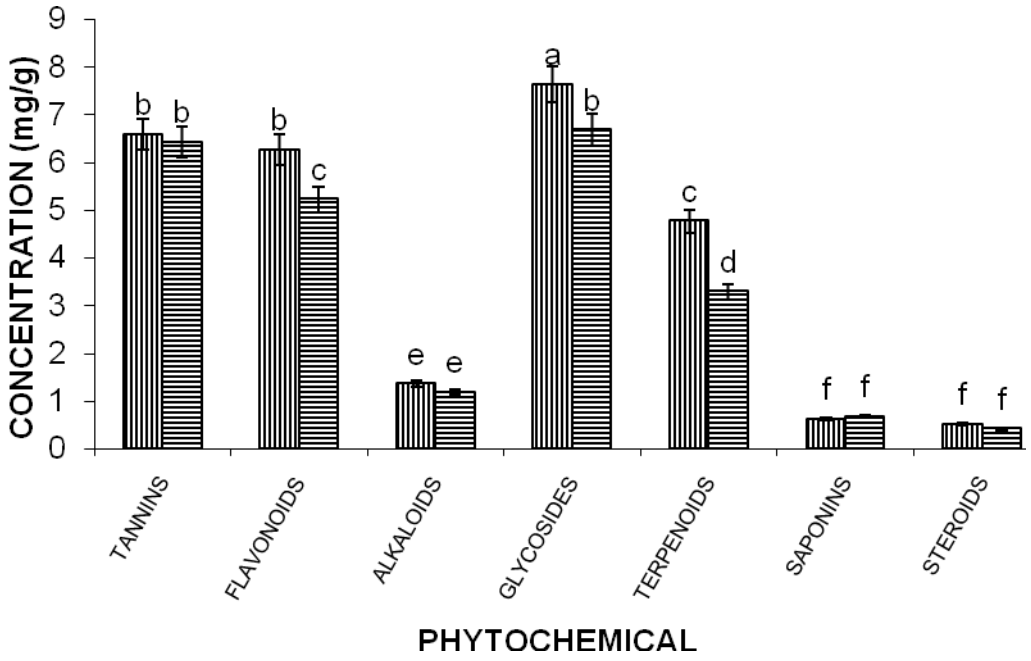


**Figure 1:Phytochemical compositions of the leaves and seeds of *Persea americana.***

**KEY:** ▨ **Leaf** ▨ **Seed**

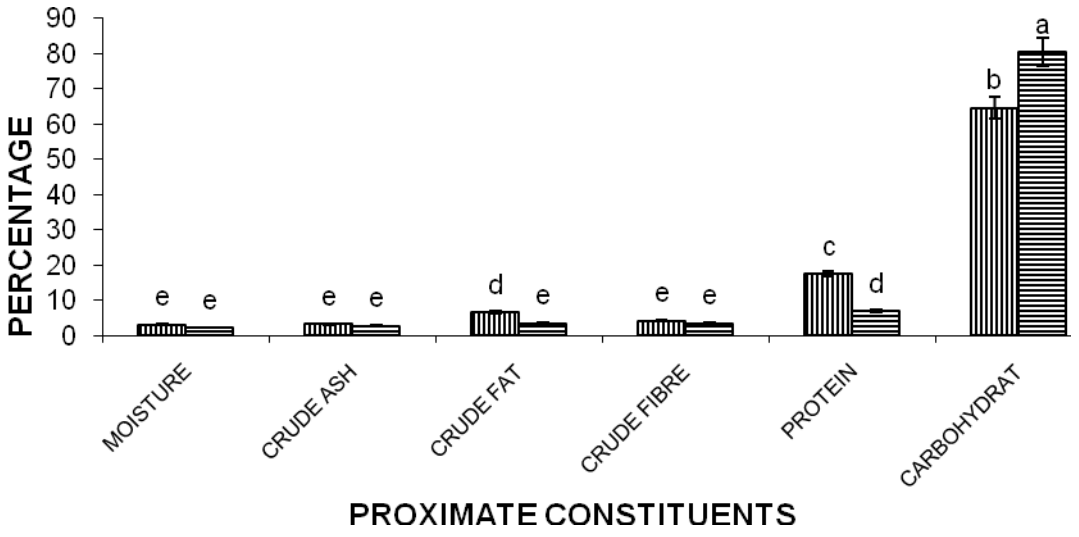


**Figure 2: Proximate compositions of the leaves and seeds of *Persea americana*.**

**KEY:** **Leaf** **Seed**

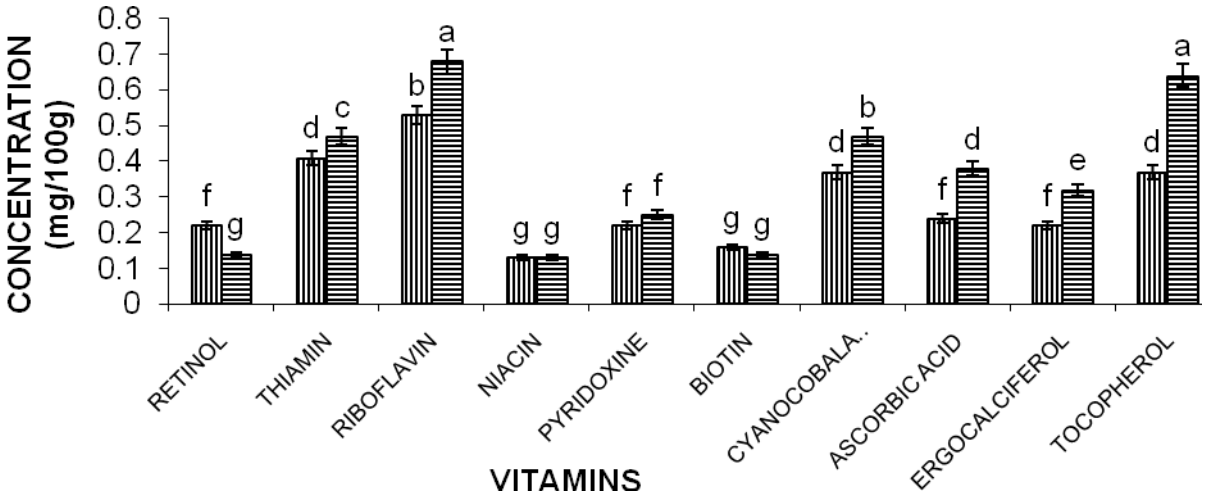


**Figure 3: Vitamin compositions of the leaves and seeds of *Persea americana***

**KEY:** **Leaf** **Seed**

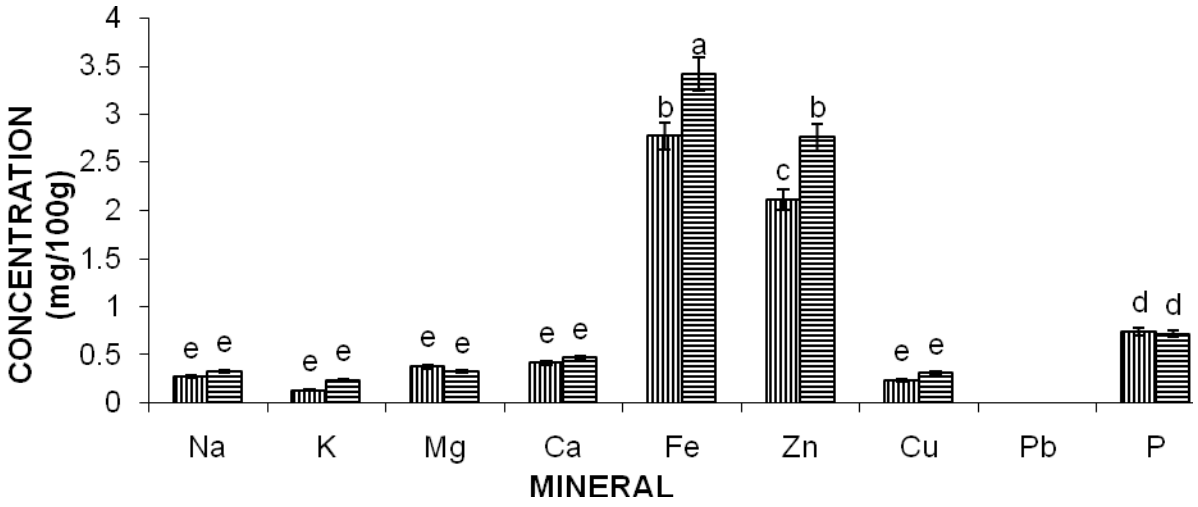


**Figure 4: Mineral compositions of the leaves and seeds of *Persea americana***

**KEY:** **Leaf** **Seed**

## DISCUSSION

Analyses of the leaves and seeds of *Persea americana* indicated that the two plant parts contained relatively high concentrations of tannins, flavoniods, terpenoids and glycosides while the concentrations of alkaloids, saponins and steroids were observed to be low in the two samples. The leaves contained significantly (P<0.05) higher concentrations of terpenoids, flavonoids and glycosides. There was no significant (P>0.05) difference in the concentrations of tannins, alkaloids, saponins and steroids between the leaves and seeds (Figure 1). [12] reported that phytochemicals are stored virtually in all plant parts and their concentrations may differ from one plant part to another. In a comparative phytochemical and nutritional study of *Phyllantus amarus* leaves and seeds, [13] reported that the seeds had higher concentrations of alkaloids and tannins compared with the leaves while the concentration of saponins were higher in the leaves indicating that there is differential distribution of bioactive compounds in various parts of plants. [14] observed that alkaloid, saponin, tannin and anthraquinone concentrations were higher in the leaves than in the seeds of *Plukenetia conophora* plant. Phytochemical analyses of *Vernonia amygdalina* and *Azadirachta indica* leaves showed that both plants contained relatively high levels of alkaloids, flavonoids and phenols and minimal concentrations of other phytochemicals [15]. A similar study on comparison of the various bioactive compounds of the leaves and seeds of *Foeniculum vulgare* mill by [16] reported that the leaves contained higher concentration of flavonoids while the seed had higher saponins concentration.

The leaves and seeds of *Persea americana* contained significantly (P<0.05) high percentage of carbohydrate and protein. Percentage moisture, fats, ash and fibre were observed to be low in both samples and there was no significant (P>0.05) difference in the moisture, ash and fibre contents of both samples. The seeds recorded significantly (P<0.05) higher percentage of carbohydrate while the leaves had significantly (P<0.05) higher protein and fat as shown in Figure 2. A

comparative nutritional study on the leaves and seeds of *Phyllantus amarus* revealed that percentage protein and ash were higher in the leaves compared with the seeds and further opined that the protein content of the leaves was essential for the synthesis and repair of body tissues and enzymes [13]. Similarly there was higher percentage of carbohydrate in the breadfruit seeds than the leaves and bark [17].

Thiamin, riboflavin, pyridoxine, cyanocobalamine, ascorbic acid, ergocalciferol and tocopherol were significantly ($P<0.05$) higher in the seeds while the leaves contained significantly ($P<0.05$) higher concentration of retinol. The concentrations of niacin, pyridoxine and biotin were not significantly different in the leaves and seeds as shown in Figure 3. [18] reported that the leaves and seeds of *Piper guinensis* (uziza) were rich in retinol, thiamin, riboflavin, niacin, ascorbic acid and tocopherol with the seeds containing higher concentrations of the vitamins. Retinol has been shown to be an important vitamin for visual, immune and foetal health [19]. The presence of ascorbic acid and tocopherol in the sample analysed suggests that they could possess antioxidant property. It has also been reported that ascorbic acid is nutritionally relevant in preventing diseases such as cancer, heart disease, obesity and diabetes mellitus [20]. Other vitamins contained in the samples particularly thiamin, riboflavin, pyridoxine and cyanocobalamine are essential for metabolic activities as they act as precursors for synthesis of coenzymes [14].

Both leaves and seeds of *Persea americana* contained significantly ($P<0.05$) high amounts of Fe and Zn with low concentrations of P, Ca, K, Mg, Na, and Cu. Pb was insignificant in both samples. The concentrations of Fe and Zn were significantly ($P<0.05$) higher in the seeds while there was no observed significant ($P>0.05$) difference in the concentrations of P, Na, K, Mg, Ca in both samples (Figure 4). [21] reported that the seeds of *Parkia biglobosa* (Africa locust beans) had higher minerals compared with the leaves. They also reported that the amounts of Ca, Mg, K, Na, Mn, Fe, Cu, and Zn in the seeds were almost double of those found in the leaves. In a similar study by [18], it was recorded that the Fe content of the leaves of "uziza" was significantly higher than that of the seeds while Na contents of the leaves and seeds were reported to be low. Iron (Fe) is often seen with copper naturally where they play important roles in cellular defense, protection of mucous membrane, antianaemic and essential for the formation of haemoglobin [14]. The high content of Zn is an indication that the leaves and seeds of *Persea americana* may play positive role in nerve functions and male fertility. Zinc (Zn) stimulates the activities of vitamins, formation of red and white blood cells, healthy functioning of the heart and serves as cofactor in biochemical reaction [22].

In conclusion, reports have indicated that therapeutic properties of medicinal plants depend largely on their chemical composition [23]; this study has shown that the leaves and seeds of *Persea americana* possess useful bioactive chemicals that could be medicinally and nutritionally relevant.

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