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Minerals, Amino Acids and Essential Oil Contents of Ethanol Extracts from Seeds and Pulps of *Artocarpus Heterophyllus*

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Abstract
Artocarpus heterophyllus is shown to be one amongst several plants shown to be blindly used by locals as nutritional supplements and for therapeutic purposes. This study examined comparatively the nutritional potentials of the seeds and pulps of *Artocarpus heterophyllus*. The minerals, amino acids and essential oil contents of ethanol extracts from seed and pulp of *Artocarpus heterophyllus* was evaluated using standard laboratory methods. Results shows that, the seed has the highest amino acid content, with glutamine being the highest in the seed (23.24g/100g) as compared to the pulp (21.74g/100g). The mineral content analysis shows that the pulp is rich in manganese (0.66mg/kg) while the seed is richest in potassium (0.6mg/kg). Iron (0.42mg/kg) and Calcium (0.42mg/kg) were observed to be higher also in the pulp. The totality of the mineral content is however, greater in the pulp than in the seed. The seed and the pulp of *A. heterophyllus* were found to contain almost the same quantity of essential oils, with the seed having higher varieties of essential oils. The study revealed that the ethanol extracts of the seed and pulp of *A. heterophyllus* are of high nutritional values as essentials minerals, oils and amino acids were seen present in the samples.
Keywords: *Artocarpus Heterophyllus,* Minerals contents, essential oils, amino acids, Ethanol Extract
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1.0 Introduction

Amongst the basic nutrient includes; Carbohydrate, protein, fats and oil, vitamins and minerals. All of which play vital and unique role in living organisms. It's no longer news that locals consume most plants' sources of these basic nutrients without cognisance of the basic role they perform and at what quantity they are required in the body. These nutrients' consistent consumption from plants over time has been connected also with lots of health benefits, though with an unclear mechanism till recent years (Nwaichi and Olua, 2015). This study examined the nutritional profile of *Artocarpus Heterophyllus,* one of the commonly consumed plants by locals without adequate prescriptions. The Minerals contents, essential oils, amino acids profile of this plant were examined

Micronutrient deficits and their significances on health, learning capabilities and productivity have been detrimental to many individuals hence constituting major public health problems of global interests (Airani, 2007; Gupta et al., 2011). Alterations in food habits especially among locals in Nigeria have immensely deterred vegetable consumption by these locals. Urbanization and globalization have also added to this challenge (Islam et al., 2015). Several individuals from diverse local communities avoid consumption of vital indigenous vegetables basically from ignorance of their nutrient composition, while in some communities some of these plants are consumed in excess without due knowledge of their acute or chronic toxicity effect. In cognizance of these observed facts, it is imperative to determine or evaluate the nutrient composition of herbaceous plant and unpopular vegetables used by rural communities for herbal purposes (Islam et al., 2015). The findings of this study however would be useful to give more details on macronutrients and possible essential oil and amino acid compositions, as well as probable antioxidant properties responsible for therapeutic actions of this herbaceous plant. This herbaceous plant could be integrated into family meals to address some micronutrient problems and their therapeutic uses could further be explored.

2.0 MATERIALS AND METHODS

2.1 Equipment/Apparatus

The following equipment were used for the experiment; Electronic weighing balance (Life Assistant co Uk) (WT2203GH), Laboratory oven (Techmel and Techmel, USA TT-9023A), Electric blender

(Panasonic electronies, LTD MX-GX1021), Refrigerator (Nexus, NX-145M), Centrifuge (Ocean med, England 800D), Rotary evaporator (Uniscope, England FM801A), Water bath (Sonic-24RT3X-2014)

Chemicals and reagents used were all of analytical grade.

2.2 Sample Collection and Preparation

Fresh seeds and pulps of *A. heterophyllus* from Obolo community in Mbano Local Government Area of Imo State were used for this study. These samples were taken to the Department of Plant Science and Biotechnology, Faculty of Science, University of Port Harcourt where they were identified.

They were air dried for three weeks after being chopped into smaller sizes. The dried samples were ground into powdered form with the aid of an electric blender. They were packaged appropriately and were for extraction. The ethanol extracts of the seeds and pulps of *A. heterophyllus* were obtained using Soxhlet extraction method.

Total Protein Isolation from Samples

Protein extraction was done using the alkaline extraction method which was described by Sarker et al., (2015). The samples were dissolved in NaOH solution of pH ranging from 7 to 12 and was filtered using Whatman filter paper.

The pH of the filtrate was adjusted using HCl solution until the isoelectric point was reached. The precipitated protein was filtered. The filtrate collected as residues were stored at 4°C for amino acid analysis.

2.3 Determination of amino acid profile of isolated protein

Amino acid analysis was done by Ion Exchange Chromatographic method using amino acid analyzer (Shimadzu Liquid Chromatograph, LC-10 AD). For the analysis, 0.5g freeze dried isolated protein sample was pasted with 50ml 6N HCl by mortar pestle and then filtered using whatman 41 filter paper. The filtrate was placed in a flask and hydrolysed for 22-24 hours. After hydrolysing, the HCl in the filtrate was totally evaporated in water bath by adding distilled water to get amino acid solution. About 25ml stock solution was prepared by adding 15ml of 0.1N HCl solution in 10ml of amino acid solution. The stock solution was used for amino acid analysis using Shimadzu Amino Acid Analyzer**.**

2.4 Mineral Analysis: Calcium assessment was done by titrimetric method (Oser, 1965), magnesium was estimated by ethylenediaminetetraacetic acid (EDTA) titrimetric method (Derderian, 1961). Microminerals (iron, zinc, copper and manganese) were estimated by wet digestion using triacid mixture (Anon., 2000).

2.5 Essential Oil Extraction from the Samples (AOAC, 1994).

The oil from the *A. heterophyllus* seeds and pulps were extracted using soxhlet extractor method. The Soxhlet extractor was powered on. The homogenized samples were placed in the extraction chamber of soxhlet unit. Extraction was done using ethanol as solvent for 48hrs.

The fatty acids presence was determined using AOAC (1994) methods. While the essential oil profile was done using gas chromatography.

2.6 Statistical Data Analysis

All statistical analysis was done using the Statistical Package for Social Sciences (SPSS) version 21.0. Data obtained were presented using charts depicting means at n=3.

3.0 RESULTS AND DISCUSSION

3.1 Amino Acid Contents of the Seed and Pulp of *Artocarpus. Heterophyllus.*

The results of the Amino Acid Contents of the Seed and Pulp of *Artocarpus. Heterophyllus* shown in figure 1 revealed presence of all 20 amino acids in both the seeds and the pulp, with glutamine (23.24g/100g and

21.74g/100g), serine (21.95g/100g and 19.13g/100g), Glycine (19.45g/100g and 18.63g/100g) and lysine (15.57g/100g and 15.93g/100g) in the seeds and pulps respectively being highest in abundance, this therefore makes the seed and pulp of *Artocarpus Heterophyllus* rich in protein quality and suggestive for preparation of high protein quality food supplement. The seeds however revealed higher amino acid contents than the pulp. Glutamine is a non-essential amino acid that eventually becomes essential when its demand exceeds supply during catabolic stress or periods of rapid growth (Hensley *et al.,* 2013; Mundi *et al.,* 2016). Lysine has been reported to facilitate the energy production, synthesis of hormones and enzymes. Isoleucine is shown to be important in blood sugar regulation (Elango et al., 2009). Amongst non-essential amino acids, tyrosine acid (6.67%) was in the highest concentration followed by glycine (4.94%).

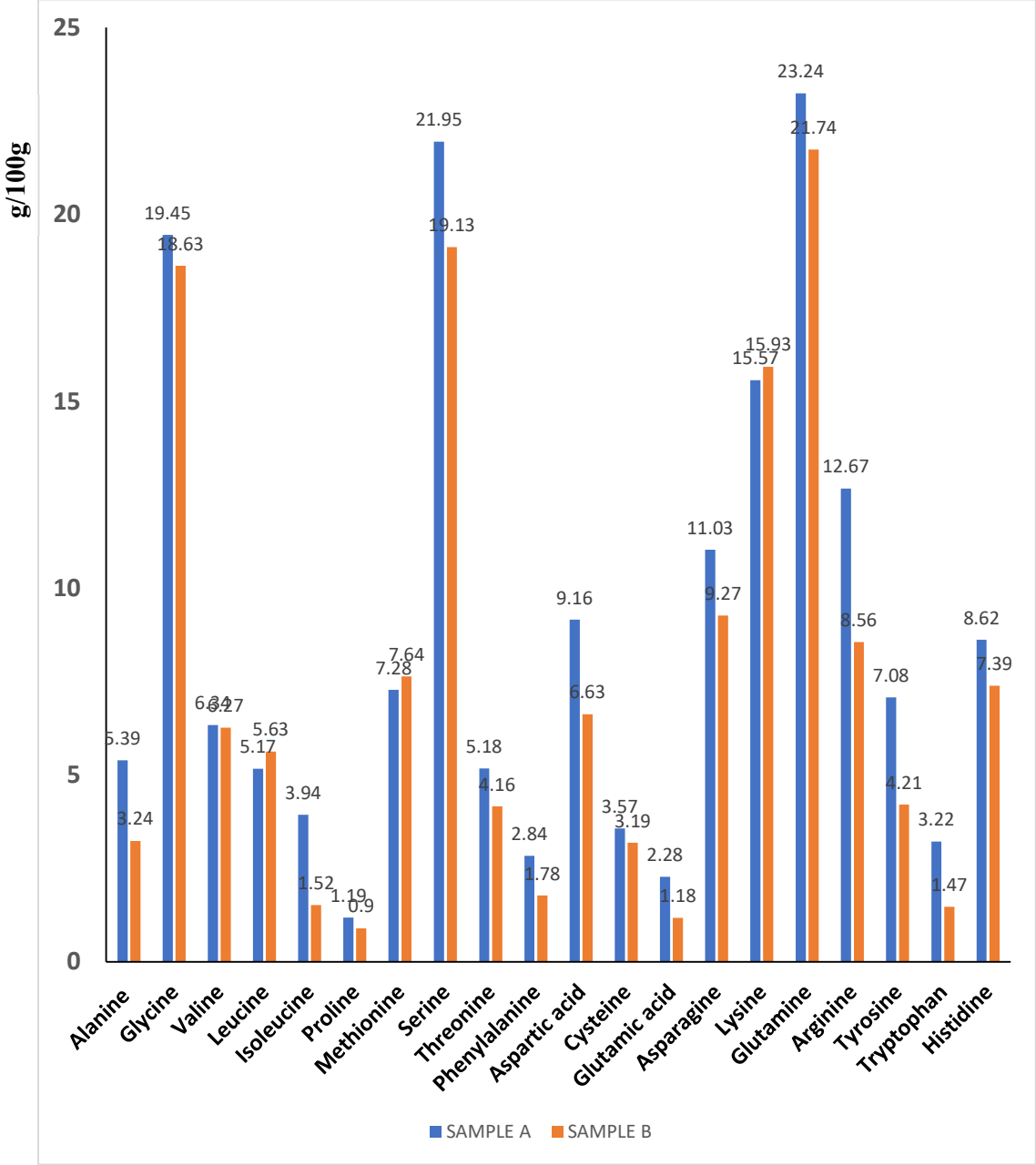

Figure 1. Amino Acid Contents of the Seed and Pulp of *Artocarpus Heterophyllus.*
Where A – Seed and B – Pulp

Inadequate amount of tyrosine reportedly leads to a deficiency of nor-epinephrine in the brain, leading to depression. This suppresses appetite, aiding reduction in human body fat (Elango et al., 2009).

3.2 Mineral Content of the Seed and Pulp of *Artocarpus. Heterophyllus.*

The Mineral Content of the Seed and Pulp of *Artocarpus. Heterophyllus* is as shown in figure 2. The obtained results revealed Mn 0.32 & 0.67mg/kg, K 0.60 & 0.004mg/kg, Fe 0.08 & 0.42mg/kg, Cu 0.12 & 0.17mg/kg, Cr 0.21 & 0.13mg/kg, Ca 0.42 & 0.06mg/kg, Zn 0.01 & 0.018mg/kg, Mg 0.22 & 0.25mg/kg for seed and pulp respectively.

The results of the The mineral composition revealed some amounts of macro and micro mineral element. Potassium was seen to be the most abundant mineral and its content was lower than the value (18.13±0.008mg/kg) reported by Isikhuemen *et al*. (2020). However, calcium content was below values 25.36±1.027mg//kg reported by Isikhuemen *et al*. (2020). The iron content was lower than 17.53±0.410mg/kg obtained by Isikhuemen *et al*. (2020) and Alade, and Ebun-Oluwa, (2020). Calcium is a crucial mineral for the development and proper functioning of bones, teeth and muscles (Turan *et al*., 2003) while potassium is an essential nutrient that functions majorly in maintaining fluid balance in the body (FAO/WHO, 2001). Iron is an essential trace element that functions as oxygen carrier from the lungs to the tissues by the red blood cells haemoglobin and act as transport medium for electron within the cells (Nair *et al*., 1997). The outcome of this study on mineral composition showed that the two parts investigated are rich sources of essential minerals and can be supplemented for other known parts and adequate consumption of it may help prevent adverse effects on dietary deficiency (Umar *et al*., 2007).

The Mineral Content (mg/kg) of the Seed and Pulp of *Artocarpus. Heterophyllus* shown in figure 4.4 contain Mn 0.32 and 0.67, K 0.60 and 0.004, Fe 0.08 and 0.42, Cu 0.12 & 0.17, Cr 0.21 and 0.13, Ca 0.42 and 0.06, Zn 0.01 and 0.018, Mg 0.22 and 0.25 for seed and pulp respectively.

3.3 Essential Oil Content of the Seed and Pulp of *Artocarpus. Heterophyllus.*

The Essential Oil Content of the Seed of *Artocarpus. Heterophyllus* shown in Figure 3 revealed presence maximum significantly seen essential oils as Hexane, 3-ethyl- (20.19), 2,6-Lutidine, 3,5-dichloro-4-cyclohexylthio- (16.3) and n-Hexadecanoic acid (11.74), while in the pulp as shown in Figure 4, maximum essential oils observed were 9,12-Octadecadienoic acid (Z,Z)- (13.61), Oleic Acid (13.37), Tetradecanoic acid (9.62), n-Hexadecanoic acid (9.55).

Essential oils are known as the aromatic essences extracted and or obtained from natural sources with verse application in pharmaceuticals, foods, perfumery, sanitary and beauty products (Ayeza *et al.,* 2018). They have been recognized as common food additives with better potencies, with little or no side effects on human and the environment, hence they are often utilized as substitutes to artificially synthesized chemical preservatives (Ayeza *et al.,* 2018). Their antimicrobial potential has also given them an edge in their therapeutic and conservative usages. Hence dietary intake of aromatic herbs, spices like *A. heterophyllus* can supply the body with adequate essential oils (Abdelouaheb, and Amadou, 2012).. Other dietary sources of essential oils, include; citrus and orange peels, cherry, spearmint, black pepper etc. reports shows that essential oils can be absorbed from foods or as pure products which can cross the blood brain barrier without difficulty due to their lipophilic nature and size. Essential oil enters human body through three exposure routes, namely; inhalation, ingestion and dermal contact (Ayeza *et al.,* 2018).

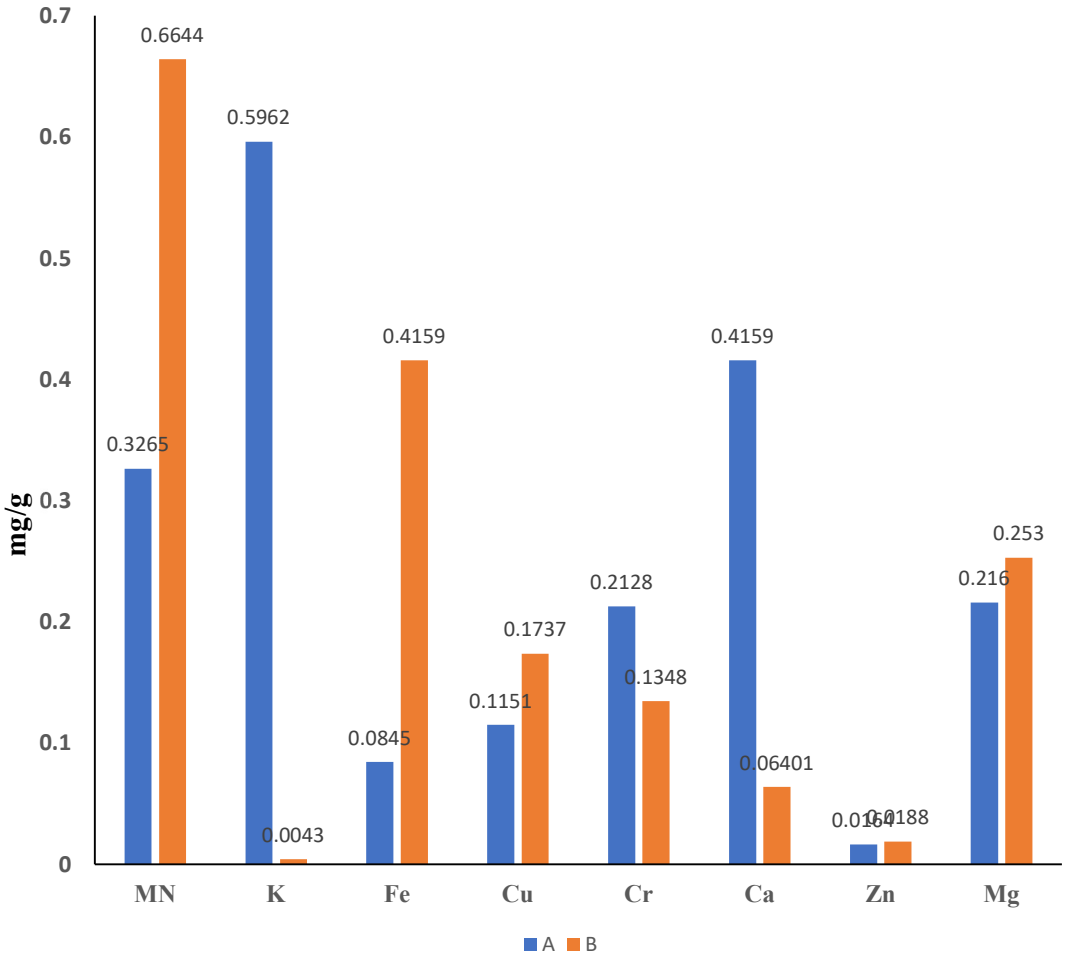

Figure 2 Mineral Content of the Seed and Pulp of *Artocarpus. Heterophyllus.*
Where A – Seed and B – Pulp

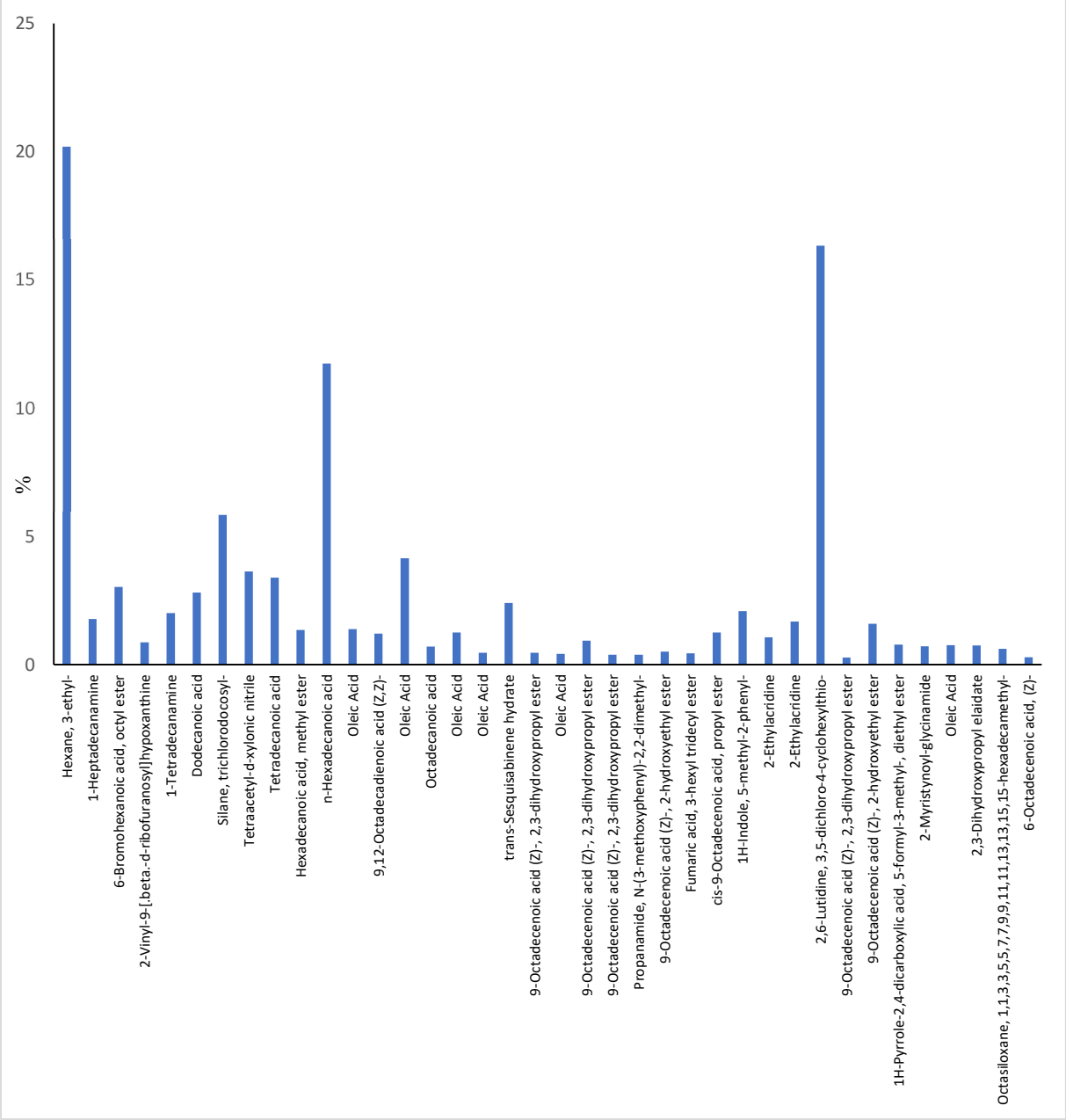

Figure 3: Essential Oil Content of the Seed of *Artocarpus Heterophyllus*

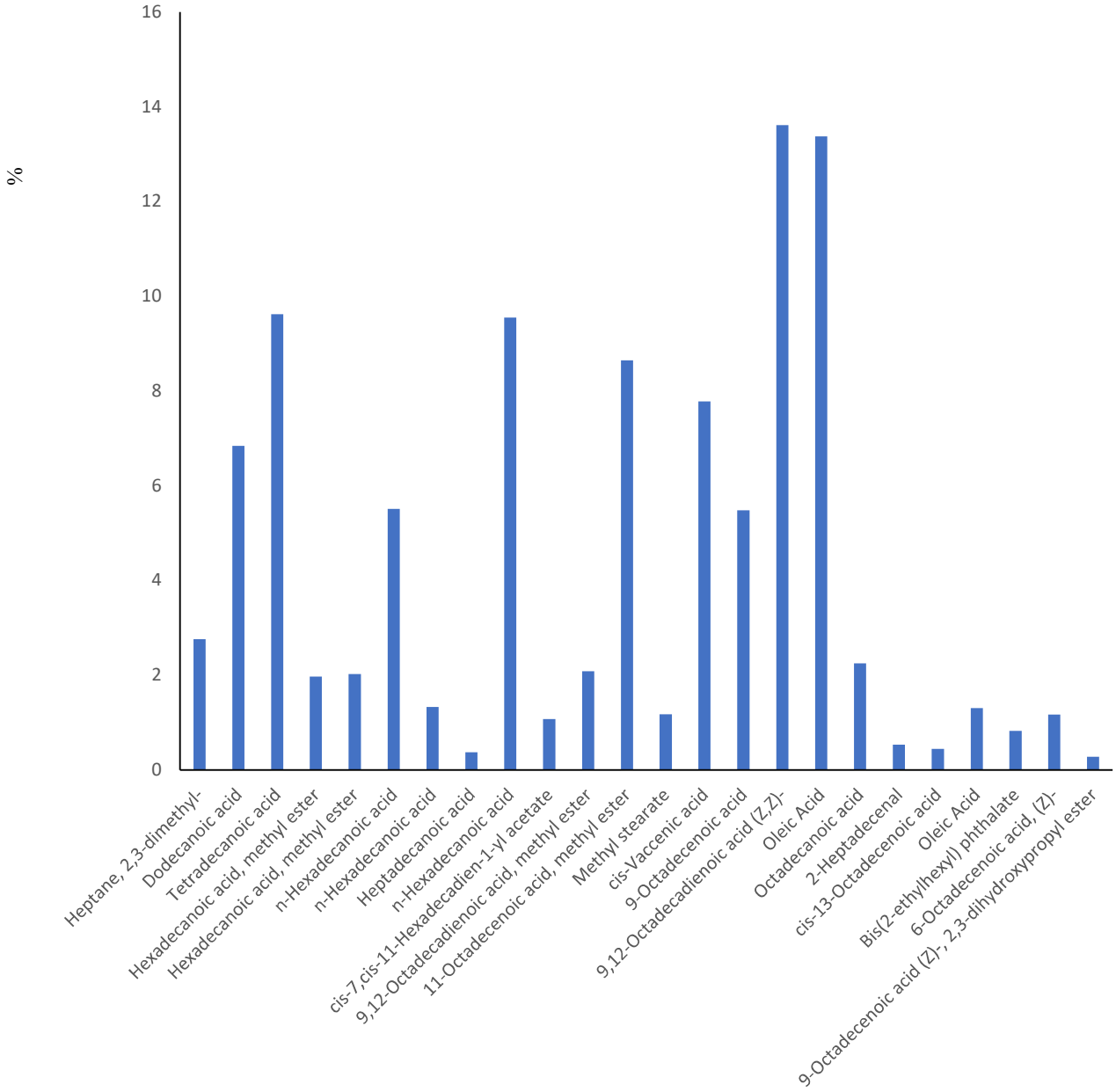

Figure 4 Essential Oil Content of the Pulp of *Artocarpus Heterophyllus.*

4.0 Conclusion

This study shows that *A. heterophyllus* contains high nutritional component with the mineral content greater in the pulp than in the seed. The seed and the pulp of *A.heterophyllus* were found to contain almost the same quantity of essential oils, with the seed having higher varieties of essential oils . The study revealed that the ethanol extracts of the seed and pulp of *A. heterophyllus* are of high nutritional values as essentials minerals, oils and amino acids were seen present in notable amounts in the samples. The present study was designed to investigate the nutritional profile of seed and pulp of *Artocarpus heterophyllus.* The findings from this study are suggestive that it could be a better nutritional supplement.

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