A Comparative Analysis of Nutritional and Chemical composition of Eight Seeds Used as Native Medicine in West Africa

ABSTRACT

Background: Rising cost of healthcare globally has prompted governments to seek for ways to treat diseases and reduce costs, plants products offers hope.
Aims: To technically conduct a comparative investigation of the nutritional and chemical composition of eight seeds used for treating diseases in West Africa. To determine edibility, suggest new food, prompt suitable choices and provide easy access of consensus evidence to busy healthcare professional.
Place and Duration of Study: Dept of Public Health, College of Health Science, Walden University, Minneapolis, USA, and Dept of Public Health, Federal University of Technology, Owerri, Nigeria between September 2022 and June 2023; research collaboration.
Methodology: A systematic review supported by a community approach to intervention services theory was used to determine seeds' composition. Search engines used, Google, Google scholar, Fire fox, and Safari.
Results: Macro and micronutrients are predominantly present. Only three seeds are consumed as food, the rest are thrashed, and some do not have enough evidence as much as modern medicine is concerned; thus, authors goal is education of both health practitioners and the public about the seeds' nutritional usefulness. Highest concentration of carbohydrates, 78.49% occurred in Chrysophillum albidum, while Plukenatia conophora ranked last, Tetrapleura tetraptera shows highest protein, while Magnifiera indica scored last, 5.67%. Carica papaya contains the highest fat, 28.3%, with Plukenatia conophora ranking last, 4.28%. Fibre concentration in Annona muricata was high, 35.20%, while Magnifera indica scored the least, 2.35%. Ash level in Tetrapleura tetraptera was highest, 5.59%, least amount occurred in Chrysophyllum albidum, 0.84%. Picralima nitida showed the highest energy level, 1468 Kcal/100 g, Magnifiera indica scored the least, 32.51 Kcal/100 g. Outcome would be beneficial to users.
Conclusion: The seeds are rich in nutrients, which link them to health control.

Keywords: [Medicinal plants, comparative analysis, native medicine, chemical composition, nutrient composition.}

1. INTRODUCTION

[There is a rising cost of providing healthcare to communities globally, including the rich countries, (4, 5, 6, 65). Many countries are now seeking for alternative ways to restore health to cut down cost. Many plants are used as folk medicine for treating many diseases in Africa, and the rising demand for alternative medicines globally makes this study a worthwhile, essentially, as 80% of the poor populations in poor countries cannot afford healthcare cost, which often comes from individual's purse. Also, serious side or adverse effects of some medicines add up to the barriers, but herbal remedies, when properly administered not only show low or no side effects but are affordable (4, 5, 6, 65). Though the global communities are facing shortage of food, all but three of the seeds investigated are usually thrown away as waste, when they are not only nutritionally rich but also possess the capacity to restore health particularly, metabolic syndrome diseases. A need has arisen to determine the edibility of the seeds and to suggest utilization of edible nuts among them not yet accepted

as food to be accepted and included in the local and global food basket. In this systematic review, the authors sought to compare the nutritional and chemical compositions of eight popular plant seeds used as traditional medicine for treating diseases in West Africa namely, Anacardium Occidentale, *Picralima nitida*, *Ananocia muricata, Magnifera indica, Plukenatia conophora, Carica papaya, Chrysophillum albidum and Tetrapleura tetraputera*. The focus was to place these plants in ranks based on nutritional and chemical concentration, which could encourage appropriate choice based upon suitability of use in relation to body conditions since many studies have already established their nutritional and chemical compositions and implicated their potency against diseases. Also, it is not all health conditions that require super strong potent agents to control, some require medium or mild treatments; hence, it was necessary to express the level of nutrient and chemical concentration of each plant to inform appropriate choice and prompt right use. The first step in doing this is to educate users about this critical information. Users include the public, health practitioners, researchers, farmers, manufacturers and policy decision makers.]

2. METHODOLOGY

The method employed was a systematic review. The focus of this research was to determine the nutritional and chemical composition of eight seeds used as folk medicines for treating various diseases and to make a comparative analysis of the nutritional and chemical composition of the investigated nuts. The seeds include; *Anacardium occidentale, Picralima nitida, Annona muricata, Magnifera indica, Plukenatia conophora, Carica papaya, Chrysophillum albidum and Tetrapleura tetraputera*. Search engines such as Safari, Google, google scholar and Fire fox were used to search for peer reviewed articles about the plants compositions. The search words were, chemical composition, and specific nutrient contents. The theory behind this study is community approach to intervention services, Only peer reviewed articles were selected and included in the data used for analysis. Non peer reviewed and article not available online were excluded. The results of nutritional and chemical composition of the investigated nuts were comparatively synthesized.

2.1 Results -

These seeds are predominantly rich in macro and micro nutrients compositions. Evidence have strongly suggested that some of the nutrients possess nutraceutical and pharmaceutical properties; thus, these properties supports its use as traditional medicines in controlling diseases. The results were synthesized and presented in four subheadings, namely, macronutrient, micronutrient minerals, trace elements, and micronutrient vitamins. Edibility of some of the seeds were determined and suggested to be included in food basket. The details of the synthesized nutrient and chemical compositions were presented on the tables namely, 1- 3.

2.1.1. Table 1. Chemical compositions of Macronutrients of Anacardium Occidentale, Picralima nitida, Annana muricata, Magnifera indica, Plukenatia conophora, Carica papaya, Chrysophillum Albidum and Tetrapleura tetraputera seeds.

Nutrients	**Magnifera Indica**	**Anacardium Occidentale**	**Annonamuricata**	**Caricapapaya**	**Plukenatia conophora**	**Picralima nitida**	**Chrysophililum Albidum**	**Tetrapleura Tetraptera**
Macronutrients	**mg/kg**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Moisture	8.01	9.70	6.13	11.02	46.03	23.30	56.04	6.58
Carbohydrates	70.78	45.78	20.05	19.70	18.10	26.58	78.49	44.91

Crude Protein	5.67	14.26	10.37	27.8	21.65	21.31	7.83	28.72
Crude fat	6.79	26.79	26.75	28.3	4.28	17.60	15.81	14.46
Crude fibre	2.37	3.20	35.20	22.60	18.00	5.95	4.19	3.14
Ash	6.11	3.46	1.50	5.21	14.25	5.56	0.84	5.59
Energy value Kcal/100kg	108.49	482.00	369.08	558.00	279.18	1468.90	474.77	424.60

Kcal: Kilo calorie
(1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 29, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64).

2.1.2. Nutritional and Chemical Composition of the Eight seeds Synthesis-Macronutrients

The seeds investigated in this study are rich in macronutrients, which occurred in each plant in varying compositional level. Moisture was present in all, *Chrysophyllum albidum*, showed the highest amount of moisture (56.04%), followed by *Plukenatia conophora*, (46.03%), *Picralima nitida*, (23.30%), *Carica papaya* (11.02%) with *Annona Muricata*, *Tetrapleura tetraptera*, *Magnifera indica*, and *Anacardium Occidentale* having low moisture concentrations , 6.13%, 6.58%, 8.01% and 9. 70% respectively.
The highest concentration of carbohydrates (78.49%) was found in *Chrysophillum albidum*, followed closely by *Magnifera indica*, (70.78%), next was *Anacardium Occidentale*, (45.78%) then, Tetrapleura tetraptera, (44.91%), Picralima nitida, (26.58%), Anonona muricata, (20.08%), *Carica papaya*, (19.70%), and *Plukenatia conophora* ranking last with 18.10%.

Tetrapleura tetraptera scored highest in protein content (28.72%), followed by *Carica papaya*, (27.80%) then, *Plukenatia conophora* (21.65%) and *Picralima nitida*, (21.31%), Anacardium occidentale, (14.28%,) *Annona Muricata*, (10.97%), *Chrysophyllum albidum* (7.83%) and the least occurred in *Magnifiera indica*. (5.67%)

Carica papaya constituted the highest fat content (28.3%) followed by *Anacardium occidentale*, (26.79%), and *Annona Muricata* (26.75%), *Picralima nitida* (17.60%), *Chrysophyllum albidum* (15.81%), Tetrapleura tetraptera (14.46%) with *Magnifiera indica* (6.79%) and *Plukenatia conophora* (4.28%) ranking last.

Fibre concentration in *Annona muricata* was significantly high (35.20%), followed by *Carica papaya*, (22.60%), next was *Plukenatia conophora*, (18.0 %). However, moderate levels occurred in *Picralima nitida, Chrysophyllum albidum, Anacardium Occidentale* and *Tetrapleura tetraptera*, with scored, (5.95%), (4.19%), (3.20%), (3.14%), respectively. The lowest score, (2.35%) occurred in *Magnifera indica*.

Ash was generally high in most of the plants, except two with low amount. Ash concentration was predominantly high in *Plukenatia conophora*, (14.25%), next was *Magnifiera indica* (6.11%), followed closely by *Tetrapleura tetraptera*, (5.59%), *Picralima nitida* ranked, (5.56%), then, Carica papaya, (5.21%), *Anacardium Occidentale*, (3.20%) and the least amount was found in *Chrysophyllum albidum*, (0.84%).

Picralima nitida showed the highest energy level with (1468 Kcal/100g), next, was *Carica papaya*, (558.00kcal/100g), then, *Anacardium Occidentale*, (482.00kcal/100 g), followed by *Chrysophyllium albidum*, (474.77 kcal / 100g), then, *Tetrapleura tetraptera* (424.60 kcal/ 100

g), *Annona muricata*, (369.08 kcal/100 g), *Plukenatia conophora*, (279.18kcal/100 g) while *Magnifiera indica*, (108.49 Kcal/100g) has the lowest score.

2.2.1. ***T Table 2. Micronutient Mineral compositions of Anacardium Occidentale, Picralima nitida, Annona muricata, Magnifera indica, Plukenatia conophora, Carica papaya, Chrysophillum Albidum and Tetrapleura tetraputera seeds.***]

Nutrients	**Magnifera Indica**	**Anacardium Occidentale**	**Annonamuricata**	**Caricapapaya**	**Plukenatia conophora**	**Picralima nitida**	**Chrysophililum Albidum**	**Tetrapleura Tetraptera**
Micro Nutrients								
Minerals mg/L	mg/100g	mg/100g	mg/ 100g	mg/ 100g	mg/100 g	mg/100 g/dry weight	mg/100 g	mg/100 g/Dry weight
Calcium (Ca)	49.00	21.50	350.00	1821.00	433.75	90.90	168.00	759.43
Potassium (K)	365.00	27.50	357.10	720.83	625.00	45.96	78.00	1175.61
Sodium (Na)	78.80	8.20	17.40	12.59	483.00	11.92	39.00	119.22
Magnesium (Mg)	0.50	19.30	12.60	28.70	171.13	1.82	90.00	167.17
Phosphorus (P)	140.00	14.00	136.00	1156.00	NR	82.91	18.00	17.00
Iron (Fe) (mg/kg)	10.10	0.60	10.00	4.20	11.00	0.45	3.48	11.50
Manganese (Mn) (mg/kg)	100.00	2.00	3.00	21.00	2.20	0.14	0.23	15.60
Zinc	5.80	0.80	6.00	6.41	4.01	106.62	0.12	1.53
Boron (B)								0.27
Cobalt (Co) (mg/kg)	1.00	0.13	NR	0.18	NR	NR	NR	2.10

Copper (Cu)	1.60	2.19	2.00	NR	1.65	NR	0.36	1.19
Selenium (Se) (mg/kg)	NR	0.04	NR	NR	NR	NR	NR	0.24
Nickel	NR	3.22	NR	3.41	NR	NR	0.51	NR
Chromium	0.80	NR	NR	NR	NR	NR	0.16	NR

NR: Not reported
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 29, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66).

2.2.2 **Micronutrient Mineral Composition of the Eight seeds Synthesis**

Macrominerals
There is high concentration of micronutrient minerals in the seeds investigated with the highest level of calcium (C) occurring in *Carica papaya*, 1821.0 mg/100 g, followed by *Tetrapleura tetraptera*, 759.43 g/100 mg, next is *Plukenatia conophora*, 433.75 mg/100 g, then, Annona muricata, 350.00, *Chrysophiloum Albidum*, 168.00 mg/100 g, *Picralima nitida*, 90.90 mg/100 g, *Magnifera indica*, 49.00mg/100 g, and *Anacardium Occidental* scoring last, 21.50 mg/100 g.

Potassium (K) was disproportionately high in *Tetrapleura tetraputera*, 1175.61 mg/100 g, next is *Carica papaya*, 720.83 mg/100 g, then, *Plukenatia conophora*, 625.00 mg/100 g, *Magnifera indica*, 365.00 mg/100 g, *Annona muricata*, 357.10 mg/100 g, *Chrysophiloum Albidum*, 78.00 mg/100 g, *Picralima nitida, 45.96 mg/100 g, and Anacardium Occidentale*, 27.50 mg/100 g scoring the least.

Sodium (Na) is too high in *Plukenatia conophora*, 483.00 mg/100 g, then, *Tetrapleura tetraputera*, 119.22 mg/100 g, then, *Magnifera indica*, 78.80 mg/100 g, next, *Chrysophiloum Albidum*, 39.00 mg/100 g, Annona muricata, 17.40 mg/100 g, Carica papaya, 12.59, *Picralima nitida*, 11.92 mg/100 g, and the least score is *Anacardium Occidentale*, 8.20 mg/100 g

The phosphorus (P) concentration in *Carica papaya* is disproportionate, 1156.00 mg/100 g, then, *Magnifera indica*, 140.00 mg/100 g, next, Annona muricata, 136.00 mg/100 g, *Picralima nitida*, 82.91 mg/100 g, *Chrysophiloum Albidum*, 18.00 mg/100 g, Tetrapleura tetraptera, 17.00 mg/100 g, *Anacardium Occidentale*, 14.00 mg/100 g, and *Plukenatia conophora*, with no score found.

Magnesium (Mg) occurred highest in *Plukenatia conophora*, 171.13 mg/100 g, then, *Tetrapleura tetraputera*, 167.17 mg/100 g, next, *Chrysophiloum Albidum*, 90.00 mg/100 g, *Carica papaya*, 28.70 mg/100 g, *Anacardium Occidentale*, 19.30 mg/100 g, Annona muricata, 12.60 mg/100 g, *Picralima nitida*, 1.82 mg/100 g, with the least score.

2.2.3. **Microminerals (Trace elements)**

Iron (Fe): The highest level of iron was found in *Tetrapleura tetraputera*, 11.50, almost same amount in *Plukenatia conophora*, 11.00 mg/100 g, followed by *Magnifera indica*, and *Annona muricata*, having 10.10 mg/100 g, and 10.00 mg/100 g respectively, then *Carica papaya*, 4.20 mg/100 g, next, *Chrysophiloum Albidum*, 3.48 mg/100 g, *Anacardium Occidentale*, 0.60 mg/100 g, and *Picralima nitida* with the least score of 0.45 mg/100 g.

Manganese (Mn): *Magnifera indica* showed the biggest concentration of manganese, 100.00 mg/100 g, followed by *Carica papaya*, 21.00 mg/100 g, next is *Tetrapleura tetraputera*, 15.60 mg/100 g, then, *Annona muricata*, 3.00 mg/100 g, *Plukenatia conophora*, 2.20 mg/100 g, *Anacardium Occidentale*, 2.00 mg/100 g, and *Chrysophiloum Albidum* and *Picralima nitida* scoring least, 0.23 mg/100 g, and 0.14 mg/100 g respectively.

Zinc (Zn): A predominant amount of zinc was found in zinc, 106.62 mg/100 g, followed by *Carica papaya* and *Annona muricata* scoring almost equal amount, 6.41 mg/100 g, and 6.00 mg/100 g, next is *Magnifera indica*, 5.80 mg/100 g, then, *Plukenatia conophora*, 4.01 mg/100 g, *Tetrapleura tetraputera*, 1.53 mg/100 g, *Anacardium Occidentale*, 0.80 mg/100 g, and scoring last with 0.12 mg/100 g.

Cobalt (Co) was found in *Tetrapleura tetraputera*, 2.10 mg/100 g, *Magnifera indica*, 1.00mg/100 g, and 0.18 mg/100 g in *Carica papaya*. It was not reported in the rest of the seeds. Also, boron (B) was reported in *Tetrapleura tetraputera*, 0.27 mg/100 g only. Boron was not reported in the rest of the seeds.

Copper (Cu): The highest amount of copper was found in *Anacardium Occidentale*, 2.19 mg/100 g, then, *Annona Muricata*, 2.00 mg/100 g, followed by *Tetrapleura tetraputera*, 1.53 mg/100 g, next is *Magnifera indica*, 1.60 mg/100 g, *Tetrapleura tetraputera*, 1.19 mg/100 g, with *Chrysophiloum Albidum* scoring the least, 0.36 mg/100 g.

Nickel (N): Nickel occurred in appreciable quantity in *Annona Muricata* and *Anacardium Occidentale*, scoring 3.41 mg/100 g, and 3.22 mg/100 g. Nickel was not reported in the rest of the seeds, and Chromium (Cr) was found in *Magnifera indica* only and not reported in the table.

2.3.1.Table 3. **Micronutrient Vitamin compositions of *Anacardium Occidentale, Picralima nitida, Annana muricata, Magnifera indica, Plukenatia conophora, Carica papaya, Chrysophillum Albidum and Tetrapleura tetraputera* seeds.**

Nutrients	**Magnifera Indica**	**Anacardium Occidentale**	**Annonamuricata**	**Carica papaya**	**Plukenatia conophora**	**Picralima nitida**	**Chrysophililum Albidum**	**Tetrapleura Tetraptera**
Micronutrient								% average
Vitamins	mg/100g	mg/100 g	mg/100g	mg/100g	mg/100 g	mg/100g	mg/100 g	mg/100g
Vitamin C	0.56	0.13	12.64	62.00	11.15	15.00	10.00	1.01
Vitamin A ug/100 g	15.27IU		5.05	47.00	NR	NR	27.00	4.21

Beta-carotene (ug/g)	NR	7.63	NR	274.00	19.75	NR	NR	0.02
Vitamin B	+	+	+	+	+	NR	+	3.35
Vitamin B1 Thiamin	0.08	0.48	11.50	0.023	66.47	NR	0.20	0.03
Vitamin B2 (g/100 g) Riboflavin	0.03	0.03	9.06	0.027	0.05	NR	0.50	0.02
B3 Niacin	NR	1.31	NR	0.36	0.02	NR	1.13	0.11
B5 Panthetonic acid	NR	0.77	1.80	0.19	NR	NR	NR	NR
B6 Pyridoxin	0.19	0.39	NR	0.38	NR	NR	NR	NR
B7 (biotin)	NR	33.60	NR	NR	NR	NR	NR	NR
Folate (B9)	NR	39.13	NR	39.00ug	NR	NR	NR	NR
Cyanacobalamin (B12) mg/100 g	0.12	0.06	NR	NR	0.07	NR	NR	NR
Vitamin E Tocopherol	1.30	5.80	NR	0.30	NR	NR	NR	2.62
Vitamin K	0.59	15.26	NR	2.60 Ug	NR	NR	NR	NR
Iodine	5.58	41.30	111.07	74.80	44.4 mg/g	136.40	47.63	11.30

(1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 29, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64).

2.3.2. **Micronutrient- Vitamins**

Being seeds or nut or kernels, it is easy to understand that the vitamin concentration in the investigated seeds were not as much as the leaves, and a significant amount of some of the vitamins were yet to be reported in some plants. However, interestingly, vitamin C is present in all the plants studied, with the highest level occurring in *Carica papaya*, 62.00 mg/100 g, then, *Picralima nitida*, 15.00 mg/100 g, followed by *Annona muricata* seed, 12.64 mg/100 g, next, is *Plukenatia conophora*, scoring11.15 mg/100 g, following by *Chrysophillum*

Albidum, 10.00 mg/100 g, *Tetrapleura tetraputera*, 1.01 mg/100 g, and *Magnifera indica*, 0.59 mg/100 g and *Anacardium Occidentale* scoring the least, 0.13 mg/100 g

Vitamin A was reported in five plants and not reported in three with *Carica papaya* scoring the highest score, 47.00 ug/100 g, followed by *Chrysophillum Albidum*, 27.00 ug/100 g, then, *Magnifera indica*, 15.00 ug/100 g and *Tetrapleura tetraputera*, 4.21 ug/100 g. Beta carotene was reported in four plants only, the highest level occurred in *Carica papaya*, 274.00 ug/100 g, next was *Plukenatia conophora*, 19.75 ug/100 g, then, *Anacardium Occidentale*, 7.63 ug/100 g, lastly, *Tetrapleura tetraputera*, 0.017 ug/100 g.

Vitamin B occurred in all the plants but except, *Hunteria umbellata* (*Picralima nitida*). Vitamin B1 occurred highest in *Plukenatia conophora*, 66.47 mg/100 g, then, *Annona muricata*, 11.50 mg/100 g, and less than 0.5 mg/100 g in the rest of the plants. B2 occurred highest in *Annona muricata*, 9.06 mg/100 g, next was *Chrysophillum Albidum*, 0.50 mg/100 g, the rest scored 0.03 mg/100 g and less. B3 was reported in five seeds namely, *Anacardium Occidentale*, *Plukenatia conophora*, *Carica papaya*, *Chrysophillum Albidum* and *Tetrapleura tetraputera*. *Anacardium Occidentale* scored highest, 1.31 mg/100 g, next is *Chrysophillum Albidum*, 1.13 mg/100 g, *Carica papaya*, 0.36 mg/100 g, *Tetrapleura tetraputera*, 0.11 mg/100 g, and *Plukenatia conophora*, 0.02 mg/100 g came last. B5 was found only in three plants namely, *Annona Muricata*, 1.80 mg/100 g, *Anacardium Occidentale*, 0.77 mg/100 g, *Carica papaya*, 0.19 mg/100 g. B6 occurred only in three plants, *Anacardium Occidentale* scored highest, 0.39 mg/100 g, *Carina papaya* almost equal 0.38 mg/100 g, and Plukenatia conophora, with the least score, 0.19 mg/100 g. B7 was found only in *Anacardium Occidentale*, with high score of 33.60 mg/100 g. B9 was found in two plants only namely, *Anacardium Occidentale*, and *Carica papaya*, with nearly equal scores of 39.13 ug/100 g and 39.00 ug/100 g, respectively. And B12 occurred in three plants only, *Magnifera indica* scored the highest, 0.12 mg/100 g, *Plukenatia conophora*, 0.07 mg/100 g and A*nacardium Occidentale*, 0.06 mg/100 g.

Vitamin E was reported in four plants and not reported in four. The least score was found in *Carica papaya*, 0.30 mg/100 g, *Magnifera indica* was higher, 1.30 mg/100 g, *Tetrapleura tetraputera*, was yet, higher, 2.62 mg/100 g, and *Anacardium Occidentale*, scored highest, 5.80 mg/100 g.

Vitamin K was not reported in five plants. It occurred only in three namely, *Anacardium Occidentale*, with the highest score, 15.26 mg/100 g, next was *Carica papaya*, 2.60 ug/100 g then, *Magnifera indica*, 0.59 mg/100 g.
Iodine content of the seeds were reported as iodine value. Only iodine value of *Plukonetia conophora* was reported in milligram (mg) per a gram, 44.4 mg/g, the rest were milligram per 100 g, mg/100 g. So, the highest concentration of iodine occurred in *Plukonetia conophora*, 44.4 mg/g, next is *Picralima nitida*, 136.40 value, *Annona Muricata*, 111.07 value, Carica papaya 74.80 value, *Chrysophillum Albidum*, 47.63 value, 41.30 value, *Tetrapleura tetraputera*, 11.30 value, *Magnifera indica*, 5.58 value.

3. DISCUSSION

All examined seeds were composed of macronutrients at acceptable amount. All contain moisture with, the highest quantity occurring in *Chrysophillum albidum*, 56.04% and the least in *Annona muricata*, 6.13%. Carbohydrates occurred in all, the least occurred in *Plukenatia conophora*, 18.00%, and *Chrysophillum albidum* scored the biggest amount 78.49%. Carbohydrates supply energy or fuel to the body for daily function. Carbohydrates occurs in various forms namely complex form such as starch, and simple carbohydrates such as simple sugar, glucose, sucrose, fructose (6, 66). Crude protein was present in all, the least occurred in *Magnifera indica*, 5.67%, and highest in *Tetrapleura tetraputera*, 28.72%. Crude proteins are essential for growth, repairs and replacement of dead cells. Crude fat was

present in all, *Carica papaya* scored the largest concentration, and the least occurred in *Plukenatia conophora*, 4.28%. Lipids are also sources of energy as well as insulation and protection to fragile cells, tissues and organs of the body (6, 66). Crude fibre and ash occurred in high levels in the seeds, which is good for general health and wellbeing essentially, chronic diseases protection such as diabetes, heart diseases, constipation and bowel movement and weight loss (6, 66). The least fibre and ash occurred in *Magnifiera indica*, 2.37%, and *Chrysophillum albidum* 0.84%, but the highest occurred in *Annona muricata*, 35.20% and Plukenatia conophora, 14.25%. All but two plant seeds showed high energy value with the biggest energy value was found in *Picralima nitida*, 1468.9 Kcal/100 g, followed by *Carica papaya*, 558.00 kcal/100 g. The least amount of energy occurred in *Magnifera indica*, 108.49 kcal/100 g.

Micronutrient minerals, which play significant functions in keeping the body healthy and protecting the body against diseases including metabolic syndrome diseases were found in the seeds at high concentrations. Calcium (Ca) occurred predominantly in all with the biggest amount in *Carica papaya*, 1821.00 mg/100 g, next is *Tetrapleura tetraptera*, 759.43 mg/100 g and the least in *Anacardium occidentale*, 21.50 mg/100 g. Calcium is good for strong and heathy bones, bone mineralization and prevention from osteoporosis, osteomalacia and demineralization. Calcium works jointly with phosphorus and vitamin D to perform its function (6, 66). Potassium (K) was predominantly high in all the plants, with *Tetrapleura tetraptera* taking the lead, 1175.61 mg/100g/dry weight and the least amount, 27.50 mg/100 g occurred in *Anacardium occidentale*. Potassium is needed for fluid and electrolyte balance in the body (6, 66). Largest amount of sodium (Na) occurred in *Plukonetia conophora*, 483.00 mg/ 100 g and *Hunteria umbellata (Picralima nitida)* scored the lowest, 11.92 mg/100 g. Just like potassium, sodium is needed for electrolyte and fluid balance (6, 66). Lowest level of magnesium (Mg) occurred in *Magnifera indica*, 0.50 mg/100 g and the highest concentration was found in *Tetrapleura tetraptera*, 167.17 mg/100 g. Magnesium is a co enzyme factor, which is involved in metabolic processes essentially in soft tissues. It is also essential, for protein, DNA and RNA production. Magnesium performs functions jointly with phosphorus and it is also called a “multipurpose mineral” involved in over 300 biochemical reactions in the body (6, 66).

There was no report about Phosphorus (P) on *Plukonetia conophora*, the least amount was found in *Anacardium occindentale*, 14.00 mg/100 g, and the biggest concentration occurred in *Carica papaya*, 1156.00 mg/100 g. Phosphorus is necessary for the body to use carbohydrates, vitamins, and minerals. It acts as a buffer, maintaining acid-base balance and the body pH. It also enhances kidney functions and regulates heartbeats. Highest score of iron was found in *Tetrapleura tetraptera*, 11.50 mg/100 g, and the lowest score in *Picralima nitida*, 0.45 mg/100 g. Manganese (Mn) was highest in *Magnifera indica*, 100.00 mg/100 g, and the least, 0.23 mg/100 g occurred in *Chrysophillum albidum*. Manganese is component of many enzymes, good for bone formation, structure, growth and healthy bones and help to prevent osteoporosis (6, 66). Boron (B) was only reported in *Tetrapleura tetraptera*, 0.27 mg/100 g. Boron regulates the effects of phosphorus and magnesium to enhance estrogen concentration of women in menopause and promote healthy bones and brain functions (6, 66). Cobalt (Co) occurred in four plants, highest in *Tetrapleura tetraptera*, 2.10 mg/100 g and the least, 0.13 mg/100 g. Cobalt is an integral of vitamin B12 and is needed for the production of red blood cells and it prevents anemia (6, 66). The least copper (Cu) was found in *Chrysophililum albidum*, 0.36 mg/100 g, and highest in *Annona Muricata*, 2.00 mg/100 g. Copper is a strong immunity booster, forms many enzyme structure (6, 66). Selenium (Se) occurred in two seeds only, *Tetrapleura tetraptera*, 0.24 mg/100 g, and *Anacardium occidentale*, 0.04 mg/100 g. Selenium protects the body from oxidative stress, infection and harmful biological development (6, 66). Nickel (N) was reported in three plants only, the least occurred in *Chrysophillum albidum* 0.51 mg/100 g, and the biggest level in *Carica papaya*, 3.41 mg/100 g. Nickel facilitates many enzyme functions, promotes vitamins B12 and B9 (folic acid) activities and lower cardiovascular diseases risk. It also maintains acids-base balance (6, 66). Chromium occurred only in *Magnifera indica*, 0.80 mg/100 g, and *Chrysophillum Albidum* 0.16 mg/100 g.

Micronutrient Vitamins, which play major functions in the general body function, promotes optimum health and wellbeing of a person and offers the body protection from all kinds of

diseases were also present in the nuts. Vitamins C occurred in all and the least in *Anacardium occidentale*, 0.13 mg/100 g and the largest in *Picralima nitida*, 15.00 mg/100 g. Vitamin C is a strong antioxidant and powerful immune booster. It neutralizes harmful free radicals, which cause cell oxidation that are foundational cause of metabolic syndrome diseases. Vitamin C prevents and heals scurvy and promotes the healing of wounds and injuries (6, 66). Vitamin A occurred in five plant seeds, highest, 47.00 ug/100 g in *Carica Papaya*, and lowest in 4.21 ug/100 g, in *Tetrapleura tetraptera*. Beta carotene occurred in four plants, and not reported in four. The least concentration, 0.02 ug/100 g, occurred in *Tetrapleura tetraptera*, and highest in *Carica papaya*, 274.00 ug/100 g. It is another powerful antioxidant and yet, while vitamin C is a water-soluble vitamin, Vitamin A is a fat-soluble vitamin. It is essential for growth thus, it is called "growth factor" during the process of it's discovery. It boosts the body immunity like vitamin C and it is essential for sight and good vision. Just like calcium, and manganese, vitamin A is needed for the formation, development and healthy bones. Additionally, quite like vitamin E vitamin A is necessary for reproduction and reproductive health and female fertility (6, 66). B group vitamins just like vitamin C, are water-soluble vitamins and they are found in all the seeds but *Hunteria umbellata*. The largest amount of vitamin B1 (Thiamin), occurred in *Plukonetia conophora*, 66.47 mg/100 g, next is *Annona muricata*, 11.50 mg/100 g, and the least 0.03 found in *Tetrapleura tetraptera*. Thiamine is essential for Beriberi prevention and treatment (6, 66).

The lowest riboflavin (B2) was found in *Tetrapleura tetraptera*, 0.02 mg/100 g and the largest in *Annona Muricata*, 9.06 mg/100 g and nothing reported in *Picralima nitida*. Riboflavin is a coenzyme factor, which is essential for lipids digestion, energy production and cell growth and in the digestion of medicines and steroids (6, 66). Largest Niacin (B3) was found in *Anacardium occidentale*, 1.31 mg/100 g and the lowest, 0.02 mg/100 g in *Plukonetia conophora*, and nothing was reported about *Magnifera indica, Annona Muricata*, and *Picralima nitida*. Niacin is necessary for preventing mouth sore, diarrhoea, dementia, pellagra and dermatitis (6, 66). Pantothenic acid (B5) was reported in three plants only, *Annona muricata*, 1.80 mg/100 g, A*nacardium occidentale*, 0.77 mg/100 g and *Carica papaya*, 0.19 mg/100 g. Nothing was reported in the rest of the plants. Pantothenic acid is involved in the production of coenzyme A (CoA) for performing other metabolic activities and it is necessary for fatty acid formation and digestion including unhealthy low density lipo protein (LDL) (6, 66). Pyridoxine (vitamin B6) was reported in three plants only, with nearly equal amount, which occurred in *Anacardium occidentale*, 0.39 mg/100 g, and *Carica papaya*, 0.38 mg/100 g and the lowest in *Magnifera indica*, 0.19 mg/100 g. Pyridoxine is involved in over 100 enzyme reactions as a coenzyme such as digestion of fat, carbohydrates, protein, homocysteine and for good brain function. Like vitamins A, C, pyridoxine boost the body immunity. Biotin (B7) occurred predominantly high in only in *Anacardium Occidentale*, 33.60 mg/100 g. Biotin is involved in fat, protein and carbohydrates digestion, body signals to the brain and gene functions (6, 66). Folic acid or folate (vitamin B9) occurred in *Anacardium occidentale*, 39.13 mg/100 g, and *Carica papaya*, 39.00 ug/100 g. Just like manganese, folate is involved in DNA and RNA formation and protein metabolism. Folate is needed for formation of red blood cells during rapid growth in children and pregnant women and it is essential for the digestion of harmful amino acid called homocysteine to further keep the body healthy (6, 66). Cobalamin (vitamin B12) occurred only on three plants, *Magnifera indica*, 0.12 mg/100 g, *Plukenatia conophora*, 0.07 mg/100 g and *Anacardium Occidentale*, 0.06 mg/100 g. Quite like folic acid, cobalamin is essential for red blood cells, nerve cells and DNA formation (6, 66).

Tocopherol (Vitamin E) was reported in four seeds only. The highest level occurred in *Anacardium occidentale*, 5.80 mg/100 g, and the lowest occurred in *Carica papaya*, 0.30 mg/100 g. Vitamin E is a fat soluble vitamins like vitamin A, which is essential for reproduction and fertility in both male and female and prevention of abortion (6, 66). Vitamin K occurred in three plants only, The highest occurred in *Anacardium occidentale*, 15.26 mg/100 g, next was *Carica papaya*, 2,60 ug/100 g, and the least, 0.59 mg/100 g in *Magnifera indica*. Highest iodine occurred in *Plukonetia conophora*, 44.4 mg/g and the lowest, 5.58 mg/100 g occurred in *Magnifera indica*. Vitamin K is essential for blood clotting, prevention of anemia and hemorrhage (6, 66).

3.1. New Food Discovery

While all the seeds possess nutraceutical and pharmacological properties, except *Picralima nitida* seed, which will need to undergo some additional investigation to discover how to use the seed safely to make animal feed after extractions, the seeds of *Magnifera indica, Annona muricata, and Chrysophillum Albidum* can be cooked or roasted to produce not just edible nuts, which are scarce to get but also, nuts with healing properties that can help to keep the global community healthy. Additionally, the seeds of *Carica papaya*, can be dried and pulverized or processed into powder to be used as food toppings or additives to enrich food to keep the society healthy. After processing, the seeds can be soled locally or exported to other countries to keep the local and global communities healthy. The gaps this discovery stands to fill are, economic value, more foods for farmers to grow, increase in buying and selling, an end to wastes of edible foods while the society is hungry and in need of food, hunger reduction and more food to the food baskets of local and global communities, and to keep the society healthy.

4. CONCLUSION

All the seeds constituted macronutrients in significant amount that can satisfy the nutritional needs of humans and animals alike, and the predominant concentration of micronutrients minerals in nearly all the seeds have been implicated as having nutraceutical and pharmacological properties, which evidence link up with capacities for health restoration. The micronutrient vitamin though not reported in some of the seeds, but the vitamins reported in some of the plants have been suggested by evidence to possess a capacity to restore health to the body. Four more seeds are edible and can be added to food basket and healthy nuts for that matter Public, researchers, public health, health practitioners, farmers, manufacturers, investors, and policy decision makers are to benefit from the findings.

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