IOSR Journal of Biotechnology and Biochemistry (IOSR-JBB)
ISSN: 2455-264X, Volume 7, Issue 5 (Sep. – Oct. 2021), PP 01-08
www.iosrjournals.org

Mineral Elements, Proximate and Vitamin Profiles of Mature Goose Grass *(Eleusin Indica)* And Pawpaw *(Carica Papaya Roots)*

IDIM, V. D

Abstract

The objective of this paper is to determined the concentration levels of some mineral elements, vitamins and proximate composition of the roots of goose grass (Eleusin indica) and pawpaw (Carica papaya) to ascertain their nutritional and medicinal potentials, using standard methods. The result obtained showed the concentration level of calcium (Ca), phosphorus (P), sodium (Na), Magnesium (Mg) and potassium (K) in pawpaw (Carica papaya) to be (0.05±0.01 g/100g, 0.00±0.00 m/100g, 0.01±0.02 g/100g, 0.00±0.03 g/100g and 0.01±0.01 g/100g, respectively; while those of goose grass (Eleusin indica) were 0.04±0.02 g/100g, 0.00±0.00 g/100g, 0.01±0.01 g/100g, 0.00±0.01 g/100g and 0.01±0.03 g/100g respectively. The concentration levels of vitamin A, B_1, C and D in pawpaw (Carica papaya) were 0.00±0.25 g/100g, 0.00±0.06 g/100g, 0.08±21.21 g/100g and 0.00±0.00 g/100g respectively; while that of goose grass (Eleusin indica) were 0.00±0.19 g/100g, 0.00±0.03 g/100g, 0.09±0.00 g/100g and 0.06±0.01 g/100g respectively. The results of proximate composition of root of pawpaw (Carica papaya) were as follows: moisture (78.83±0.25%), carbohydrate (14.49±0.42%), crude protein (3.27±0.22%), fiber content (10.45±0.16%), ash (10.73±0.28%) and fat content (3.21±0.14%). The proximate composition of root of goose grass (Eleusin indica) was moisture (22.22±0.25%), carbohydrate (42.17±0.51%), crude protein (2.86±0.22%), fiber (13.55±0.16%), ash (16.05±0.47%) and fat content (3.16±0.00%). The results obtained showed that the concentration level of Ca, in pawpaw was higher (0.05±0.01 g/100g). Result of proximate analysis showed that root of goose grass has the highest proportion of carbohydrate, fiber and ash (42.17±0.51%, 13.55±0.16% and 16.05±0.47% respectively) while pawpaw has higher content of moisture, crude protein of 78.83±0.25% and 3.27±0.22% and 3.21±0.14% respectively, which was indicative of higher nutritional value. However, goose grass had the higher level of vitamin C and D. Based on the result of the analysis, it was recommended that the two plants could be used as alternative natural antioxidants. It is concluded that they are also good sources of mineral elements analyzed, which are naturally occurring inorganic elements required as essential nutrients by organisms to maintain optimal health.

Date of Submission: 25-08-2021 Date of Acceptance: 09-08-2021

I. Ntroduction

Goose grass (Eleusin indica) and pawpaw (*Carica papaya)* (Fig. 1 and 2) respectively are plants found in the tropical and subtropical regions, where they are used for both medicinal and food purposes. Goose grass (*Eleusin indica)* and pawpaw (*carica papaya)* belongs to the family of *Poacea* and *Caricaceae* respectively.

Figure 1: *Eleusin indica*

Figure 2: *Carica papaya*

Eleusin indica is coarse, caespitose annual, branching at the base, 30-60cm tall. The whole plant especially, the root is depurative, diuretic, febrifuge, laxative and sundorific (Kulip, 1997). Poacea are eaten as conventional or functional food such as vegetables, spices as well as herbal teas and may also provide a source of food additive (Lim, 2016). The root of this plant can be consumed either raw or cooked (Kunle, 1984). The plant is used to overcome the problem of green roughage scarcity in Nepal (Regmi *et al.*, 2004). The seed is normally used as famine food and also in the treatment of liver complaints (Igbal and Gnanara 2012).The young seedling, either raw or cooked are used as side dish with rice (Usher, 1974; Facciola, 1990).

The infusion of aerial parts is used in Brazil against airway inflammatory processes, such as influenza and pneumonia (De-Melo *et al.*, 2005).

Pawpaw *(Carica papaya)* on the other hand, is uniquely regarded as the fruit of the Angels. It is such a plant that virtually all its parts such as pulps, roots, fruits, peels, bark, leaves and seeds are highly medicinal and effective for tackling several diseases (Ayoola and Adyeye *et al.*, 2010). The aqueous extract of the roots of this plant have shown that the concentrations of the trace elements are within the permissible level (Idim, 2017). The bark, roots, twigs and seeds of pawpaw (*Carica papaya)* plant contain acetogenins. They are polyketide–derived molecules and are unique to the Annonaceae family and are known for their cytotoxic, antitumor, immunosuppressive, antimalaria, pesticidal, antibacterial and antifeedant properties (Bruneton, 1995). Aqueous extract of the leaves of this plant have shown potential activity in the management of dengue fever (Ahmad *et al*., 2011). The leaves extract also showed antitumor and immune modulatory activities (Otsuki 2010). The plant display antioxidant, antimicrobial and anticancer activities (Kaur and Arora 2009; Kiruba *et al.,* 2011). Alcoholic extracts of the roots and seeds from *papaya* have antidiarrheic, antidysenteric and antibacterial properties (Doughari *et al.,* 2007). The therapeutic benefit of the medicinal plants is often attributed to their antioxidant properties (Al-Zubairi *et al.*, 2011), however, vitamin B, C, E, carotenoids and phenolic compounds are the most abundant antioxidants that are present in the plant food (Harnadez *et al.,* 2006; Lim *et al.*, 2007). The fruits and leaves of pawpaw (*Carica papaya)* have been reported to have high antioxidant capacity due to their high contents of vitamin B (in leaves), vitamin C, E (in fruits) and carotenoids (Lim *et al.*, 2007; Setiawan *et al.,* 2001; and Wall, 2006). This study aims to analyse the vitamins, mineral elements and proximate composition of the roots of two tropical and subtropical plants in order to preliminarily assess their nutritive and medicinal value with particular reference to vitamins A, B_1, C and D as well as magnesium (Mg), Potassium (K), Calcium (Ca), Sodium (Na) and Phosphorus (P).

II. Materials And Methods

Sample collection: *Eleusin indica* and *Carica papaya* fresh roots were harvested from the premises of Cross River University of Technology (CRUTECH) staff quarters, Calabar, Cross River State, Nigeria, and carried to the Herbarium of Botany Department of the University of Calabar, Cross River State, for identification.

Sample processing: The fresh roots of test plants, pawpaw (*Carica papaya)* and goose grass (*Eleusin indica*) were washed and cut into tiny pieces with the help of a stainless steel knife and air dried for 7days. The samples were pulverized using corona grinding machine. 5.0g of each of the pulverized samples were measured into a separating funnel and extraction was done after adding 50ml of methanol and shake for seven minutes.

The mixture was allowed to stand for 2 minutes, after which the liquid extract were separated and filtered, followed by evaporation in a hot water bath to make 15ml of the original volume of the extract. They were labeled accordingly for the determinations of vitamins A, B_1, C, and D.

Determination of the vitamins

(i) Determination of Vitamin A

The AOAC (1995) method of determination was used (Alobi *et al.*, 2013). In the determination of vitamin A, a drop of isopropanol ether and a drop of concentrated H_2SO_4 were added to 2.0ml of each of the extracts followed by the addition of a drop of formaline. The mixture was shaken for homogeneity and left to stand for the development of blue colour before measurement of the vitamin with Uv-vis spectrophotometer at a wavelength of 325nm with a solvent blank as standard. The level of vitamin A was determined by using the formula below:

Vitamin A concentration (μg/ml) = $\frac{T_1 - T_2}{St_1 - St_2} \times Stc \times Dilution\ factor$

Where T_1 = The absorbance of the blank sample

T_2 = The absorbance of the sample test (analyte)

St_1 = The absorbance of standard blank

St_2 = The absorbance of standard Vitamin A

Stc = Standard concentration

(ii) Determination of Vitamin B_1

The determination of vitamin B_1 was done by adding 0.5ml of 0.5% special reagent and 10 drops of diazo dye and 0.5ml of each of the sample extracts into separate test tubes. Standard thiamin (1mg/100ml) was also prepared with the addition of a special reagent prepared the same way as for sample and allowed to stand for a few minutes for colour development before measuring the absorbance with the Uv-vis spectrophotometer at a wavelength of 550nm. The concentration of Vitamin B_1 was determined using the formula below:

Vitamin B_1 (mg/ml) = $\frac{T_1 - T_2 \times Stc \times DF}{Abs}$

Where	T_1	=	The absorbance of sample
	T_2	=	The absorbance of blank
	Stc	=	Standard concentration
	DF	=	Dilution factor
	Abs	=	Absorbance of standard Vitamin B_1

(iii) Determination of Vitamin C

Vitamin C was determined by weighing 12.0g of the crushed plant roots into separate extraction funnels, 20mls of methanol was then added. The mixture of each of the root samples was allowed to stand for 10 minutes before extraction by agitation for 3 minutes. After the extraction, each of the supernatants was decanted into 250ml beaker before evaporation on a hot water bath at 35^oC to remove the methanol content. Thereafter, 5.0ml of each of the fresh extracts was measured into separate conical flasks and made up to 100ml with distilled water. 0.01g of standard vitamins was also prepared using 100ml of distilled water. These were titrated against 1ml of 0.0lM of 2, 6 dichlorophenol indophenols indicator in conical flasks and the blue colouration indicated the end point. The level of Vitamin C was determined using the formula below:

Vitamin C(mg/ml) = $\frac{L - B \times T \times DF}{Z - B}$

Where	L	=	Titre value of test solution
	B	=	Titre value of blank
	T	=	Concentration of standard solution
	DF	=	Dilution factor
	Z	=	Titre value of standard ascorbic acid solution

(iv) Determination of Vitamin D

Vitamin D was determined by measuring 0.5ml of aniline hydrochloride and 0.5ml of each of the plant extracts into two separate dried test tubes and then placed them on hot water bath to boil with continuous shaking. The mixture in each tube was allowed to boil for 30 seconds for colour development which indicated the presence of vitamin D. However, Vitamin D was measured using the UV-Vis spectrophotometer at the wavelength of 280 nm. The vitamin was then calculated using the formula below:

Vitamin D concentration (mg/ml) = $\frac{T_1 - T_2 \times Stc \times DF}{Abs}$

Where	T_1	=	The absorbance of sample
	T_2	=	The absorbance of blank sample
	Stc	=	Standard concentration
	Abs	=	Absorbance of standard Vitamin D
	DF	=	Dilution factor

Mineral Elements Analysis

One gramme (1g) of the pulverized sample was weighed separately and placed into 3 different 250ml of kjeldahl digestion flasks. Each flask was filled with 20ml of strong acid mixture of 650ml concentrated nitric acid (HNO_3), 200ml perchloric acid (PCA) and 30ml of concentrated sulphuric acid (H_2SO_4). The mixture in each of the flasks was thoroughly shaken for proper mixing for 1 minute under tap water and then heated for 30 minutes with the help of kjeldhal apparatus in a fume cupboard until a clear solution was obtained. The clear solutions were filtered with No 1 Whatman filter papers and transferred into a 100ml volumetric flasks and then made to mark with de-ionized water. In triplicate, the flasks were then analysed for mineral elements using Atomic Absorption Spectrophotometer (AAS), Unicam 919 model in accordance with standard method (AOAC, 1995).

Proximate Analysis

The proximate parameters (ash, crude fiber, crude fats, proteins, carbohydrates and moisture content) were determined using Association of official Analytical Chemists Methods (AOAC, 2005). The ash values were obtained by heating samples at 570°C in a muffle furnace for 3 hours. The crude fiber was determined by acid-base digestion with 1.25% H_2SO_4 (v/v) and 1.25% NaOH (w/v) solutions (Al-Harrasi *et al.*, 2012). Crude fats were determined by soxhlet apparatus with ethyl acetate as a solvent. The amount of lipid extracted was obtained as the difference between the weight of the flask before and after the extraction (AOAC, 2005).

Nitrogen estimation was carried out by the micro kjeldahl method (AOAC, 2005). The crude proteins were therefore calculated by multiplying the nitrogen content by a factor of 6.25 (AOAC, 1995). Carbohydrate content was determined by subtracting the total crude protein, crude fiber, crude fat, ash and moisture content from the total dry matter (AOAC 2005). Determination of moisture content was done by drying samples in an air circulating oven at 118°C until constant weight was attained (AOAC, 2005).

III. Results

The results from the analysis of mineral elements, vitamins and proximate composition of the roots of goose grass (*Eleusin indica)* and pawpaw (*Carica papaya)* are presented in table 1, 2 and 3 respectively. The highest mineral element content of the *Carica papaya* and *Eleusin indica* roots were calcium (Ca) 0.05±0.01 g/100g and 0.04±0.02 g/100g respectively, followed by Potassium (K) 0.01±0.01 g/100g and 0.01±0.03 g/100g for the pawpaw (*Carica papaya)* and goose grass (*Eleusin indca),* respectively. *Elsusin indica* root had the higher level of vitamin C (0.09±0.00 g/100g) and vitamin D (0.06±0.01 g/100g). The proximate analysis is presented in table 3. The carbohydrate, ash and fibre contents were higher in goose grass (*Eleusin indica)* than in pawpaw (Carica papaya); while pawpaw (*Carica papaya)* had higher proportion of crude protein and moisture (3.27±0.22% and 78.8±0.25% respectively) than Eleusin indica (goose grass).

Table 1: Mineral elements composition of goose grass (*Eleusin indica)* root and pawpaw (*Carica papaya)* root

Sample	Ca (g/100g)	Mg (g/100g)	P (g/100g)	Na (g/100g)	K (g/100g)
Goose grass *(Eleusin indica)*	0.04±0.02	0.00±0.01	0.00±0.00	0.01±0.01	0.01±0.03
Pawpaw *(Carica papaya)*	0.05±0.01	0.00±0.03	0.00±0.00	0.01±0.02	0.01±0.01

All values are means ± standard deviation of triplicate measurements.

Table 2: Vitamin composition of goose grass (*Eleusin indica)* root and pawpaw (*Carica papaya)* root

Sample	Vitamin A (g/100g)	Vit. B_1 (g/100g)	Vit. C (g/100g)	Vit. D (g/100g)
Goose grass *(Eleusin indica)*	0.00±0.19	0.00±0.03	0.09±0.00	0.06±0.01
Pawpaw *(Carica papaya)*	0.00±0.25	0.00±0.06	0.08±21.21	0.00±0.00

All values are means ± standard deviation of triplicate measurements.

Table 3: Results of proximate percentage (%) composition of roots of goose grass (*Eleusin indica)* and pawpaw (*Carica papaya)*

Sample	Moisture (%)	Carbohydrate (%)	Crude protein (%)	Fiber (%)	Ash (%)	Fat (%)
Goose grass *(Eleusin indica)*	22.22±0.25	42.17±0.51	2.86±0.22	13.55±0.16	16.05±0.47	3.16±0.00
Pawpaw (*Carica papaya)*	78.83±0.25	14.49±0.42	3.27±0.22	10.45±0.16	10.73±0.28	3.21±0.14

All values are means ± standard deviation of triplicate measurements.

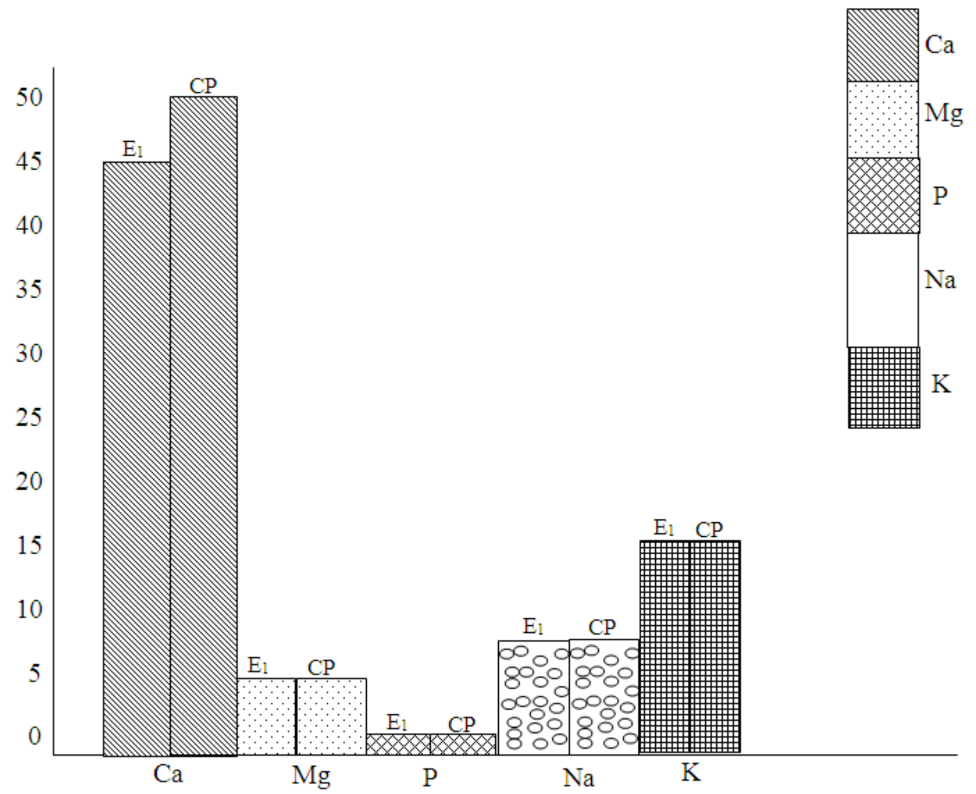

Figure 1: Mineral element levels in roots of *Eleusin idica* (E.I) and *Carica papaya* (C.P)

IV. Discussion

The results of mineral element determinations of pawpaw (*Carica papaya)* and goose grass (*Eleusin indica)* as presented in table 1 showed that, pawpaw (*Carica papaya)* has the highest concentration of calcium (Ca), (0.05±0.01 g/100g than the goose grass *(Eleusin indica)*. The difference in concentration of mineral elements in pawpaw (*Carica papaya)* and goose grass *(Eleusin indica)* are presented in figure 1 which showed that the values of all the mineral elements in the two samples are at close range. Mineral elements are naturally occurring inorganic elements or compound having characteristic chemical and physical properties. Mineral elements are required as essential nutrients by organisms to perform functions necessary for life (Berdanier *et al*., 2013) and to maintain optimal health. The five major mineral elements in the human body are calcium (Ca), Phosphorus (P), Potassium (K), Magnesium (Mg) and Sodium (Na) (Berdanier *et al.,* 2013). These mineral elements are also metabolized for growth, development and vitality of living organisms (Skinner, 2005; Kirkby *et al.*, 1996 and Adame, 2002).

Potassium (K) is a very important element for the proper functioning of all cells, tissues and organs in the human body. Its maintains fluid and electrolyte balance in the body. Potassium helps in promoting normal heart rate (O' Donnel *et al.,* 2011). It prevent serious bone-related health issues like osteoporosis (Newnham, 2001), it boost heart health (Matsui *et al.,* 2006). Potassium also plays an important role in keeping the body hydrated and works with sodium to support cellular function with the body's sodium-potassium pump (Adrogue and Madias 2014).

A deficiency in potassium can lead to fatigue, constipation, irritability, muscle cramps, weight gain, blood pressure problems, cellulite build-up, nausea, arthritis, abdominal cramping, bloating and abnormal psychological behaviour, including depression, confusion or hallucinations (O' Shaughnessy, 2006).

Symptoms of low potassium includes hypokalemia which include severe headaches, dehydration, heart palpitations and swelling of glands and tissues.

The current recommended dietary intake for male and female adults is 4,700 milligrams per day (Cogswell *et al.,* 2012). According to the Food and Nutrition center of the Institute of Medicine, the recommended daily intake of potassium is: infants 0-12 months: 400-700 mg/day, children 1-8 years 3060-3,800 mg/day, Teens 9-18 years: 4,500-4,700 mg/day, Adults: 19 years and above, men and women: 4,700 mg/day, pregnant women/nursing mothers 5,100 mg/day (Perazella, 2000).

Based on the above recommended dietary intake of potassium according to the food and nutrition center of the institute of medicine, the result of the potassium content highlighted implies that this mineral elements in the two samples can be of health benefit..

Calcium is also one of the essential mineral elements which has several important functions to include the regulation of muscle contractions and heart beat, its also helps in building strong bones and teeth. However, lack of calcium causes rickets in children and osteomalacia or osteoporosis in later life (Institute of Medicine, 1999).

The recommended dietary intake of calcium is: infant 0-6 months (breastfed) approximately 210 mg/day, infant 0-6 months (formula fed) 350 mg/day, 7-12 months 270 mg/day, 1-3 years 500 mg/day, 4-8 years 700 mg/day, 9-11 years 1,000 mg/day, 12-18 years 1,300 mg/day, women 19-50 years 1,000 mg/day, 51-70 years 1,300 mg/day, while men 19-70 years 1,000 mg/day, 71 and above 1,300 mg/day (Institute of Medicine, 1999). The result of calcium content in the two samples compared to the recommended dietary intake (RDI) suggests that the two samples can be of health benefit.

The therapeutic benefit of medicinal plants is usually attributed to their antioxidant properties (Zhang *et al.,* 2001; Rice-Evans, 2004 and Dixon *et al.,* 2005), since most of the synthetic antioxidants are usually carcinogenic (Mahdavi and Salunkhe, 1995). There is therefore, a need for identifying alternative natural and safe sources of antioxidants, especially of plant origin, which ideology has increased in recent years (Zainol *et al.,* 2003). Vitamin B, C, E and so on, are the most abundant antioxidants present in plant foods (Harnadez *et al.,* 2006; Lim *et al.,* 2007). In this study, the goose grass *(Eleusin indica)* has higher concentration of vitamin C and D as shown in the table 2 (0.09±0.00 g/100g and 0.06±0.01 g/100g), than pawpaw (0.08±2121 g/100g and 0.00±0.00 g/100g) respectively.

Vitamin C is an essential nutrient which aids in many biological functions such as the synthesis of collagen, healing of wounds, repair and maintenance of cartilage, bones and teeth. However, vitamin C is an antioxidant which helps in neutralization of free radicals that damage cells at the genetic level. Deficiency of vitamin C leads to scurvy which slows the rate of collagen formation therefore causes wounds to heal more slowly (Shaikh *et al.,* 2019). The recommended dietary allowance (RDA) in milligrams (mg) are: children 0 to 6 months 40 mg/day, 7 to 12 months 50 mg/day, 4 to 8 years 25 mg/days, 9 to 13 years 45 mg/day, female 14 to 18 years 65 mg/day, male 14 to 18 years 75 mg/day, female 19 years and over 75 mg/day, male 19 years and over 90 mg/day, pregnant female 14 to 18 years 80 mg/day, pregnant female 19 years and over 85 mg/day, breast feeding female 14 to 18 years 115 mg/day and the breast feeding female 19 years and over 120 mg/day (Institute of Medicine, 2000). However, the result of vitamin C content highlighted indicated that, this nutrient in the two samples compared to the recommended dietary intake (RDI) will serve as vital nutrient for the proper functioning of the cells, tissues and organs in human body.

Vitamin D is also one of the essential nutrients which has diverse roles in metabolic reactions such as maintenance of normal blood levels of calcium and phosphate. This inturn sustains the normal mineralization of bone, muscle contraction, nerve conduction and general cellular function in all cells of the body. It also has immuno-modulatory properties that may alter responses to infection in vivo (Berardi *et al.,* 2009). Vitamin D, also known as calciferol is a fat soluble vitamin, however its deficiencies is rickets in children and osteomalacia in adults. The recommended dietary allowance in micrograms (mcg) are: children 0 to 5 months 5 mcg/day, 6 to 11 months 5 mcg/day, 1 to 3 years 5 mcg/day, 4 to 50 years 5 mcg/day, 51 to 65 10 mcg RE/day, men > 65 years 15 mcg/day, women > 65 years 15 mcg/day, pregnant female 5 mcg/day and lactating female 5 mcg/day (FAO/WHO, 2002). The result of vitamin D content compared to the recommended dietary intake showed that the plants will serve as essential source for nutrient intake.

Proximate principles of goose grass *(Eleusin indica)* and pawpaw *(Carica papaya)* roots help to play a role in assessing their nutritional significance as well as medicinal role.

The results showed that roots of goose grass *(Eleusin indica)* had a higher proportion of fiber, carbohydrate and ash value of (13.55±0.16%, 42.17±0.51% and 16.05±0.47%) respectively, than pawpaw with corresponding values of 10.45±0.16%, 14.49±0.42% and 10.73±0.28% respectively. While moisture and crude protein were higher in pawpaw *(Carica papaya)* root (78.83±0.25% and 3.27±0.22%) respectively than in goose grass (22.22±0.25% and 2.86±0.22%) respectively. This study revealed that roots of these plants can be essential source for dietary intake.

V. Conclusion

The results of this study showed that both the goose grass *(Eleusin indica)* and pawpaw *(Carica papaya)* roots possess antioxidant properties and could be used as alternative natural antioxidants. The root of the plants also contain high levels of mineral elements (Ca, Na and K), therefore, making them a good source of these mineral elements for nutritional purposes. Also, the permissible level of trace elements allow the use of these plants for medicinal purposes of great importance (Idim, 2017). The proximate composition ascertain the fact that the two plants can be of health benefit.

References

[1]. Adame, I. (2002). "Leaf absorption of mineral nutrients in carnivorous plants stimulates root nutrient uptake" (PDF). *New phytologist,* 155:89-100.

[2]. Adrogue, H. J. and Madias, N. E. (2014). The impact of sodium and potassium on hypertension risk. *Semin Nephro,* 34(3):257-272.

[3]. Ahmad, N., Fazal, H., Ayaz, M., Abbasi, B. H., Mohammad, I. and Fazal, L. (2011). Denque fever treatment with *Carica papaya* leaves extracts. *Asian pac J. Trop Biomed,* 1(4):330-333.

[4]. Alobi, N. O., Enyi-Idoh, K. H., Okoi, A. I., Abara, A. E. and Eja, M. E. (2013). Vitamin profiles of *cnidoscolus carumbium* (Hospital no far) and *spigelia marilandica* (worm grass). *Journal of Science, Engineering and Technology*, 2(2):59-61.

[5]. Al-Harrasi, A., Al-Rawahi, A., Hussain, J., Rehman, N., Ali, L. and Hussain, H. (2012). Proximate analysis of the resins and leaves of Boswellia Sacra. *J. Med. Plants Res.* 6(16):3098-3104.

[6]. Al-Zubairi, A. S., Abdul, A. B., Abdeiwahad, S. I., Peng, C. Y., Mohan, S. and Eihassan, M. M. (2011). *Eleusine indica* possesses Antioxidant, Antibacterial and Cytotoxic properties 2011 p.6 http:/dx.doi.org/10.1093/ecam/hep091.

[7]. AOAC (1995). Official Methods of Analysis. Association of Official Analytical Chemists, *Washington* DC.

[8]. AOAC, (2005). Safety of foods and dietary supplement United State department of agriculture. *USA Journal of AOAC*

[9]. Ayoola, P. B. and Adyeye, A. (2010). Phytochemical and nutrient evaluation of Carica papaya (paw paw) leaves. *Int. J. Res. Rev. Appl. Sci.* (*IJRRAS*), 5(3):325-328.

[10]. Berardi, R. R., Newton, G., McDermott, J. H. (2009). Handbook of nonprescription drugs. 16th ed. *American Pharmacists Association*.

[11]. Berdanier, C. D., Dwyer, T. T. and Heber, David (2013). Handbook of Nutrition and Food. 3rd ed. *CRS Press.* pp. 199 SBN 978-1-4-4665-0572-8.

[12]. Bruneton, J. (1995). Pharmacognosy, phytochemistry, medicinal plants. *Paris, France*: *Lavoisier*, p. 156.

[13]. Cogswell, M. C., Zhang, Z., Cariquiry, A. I. (2012). Sodium and potassium intakes among US adults: NHANES 2003-2008. *Am. J. Clin. Nutr.,* 96(3):647-657.

[14]. De-Melo, G. O., Muzitano, M. F., Legora, M. A., Almeida, T. A., Deoliveira, D. B., Kaiser, C. R. et al., (2005). C-Glycosylflavones from the aerial parts of *Eleusin indica* inhibit LPS-induced mouse lung inflammation. *Planta Med.* 71(4):362-363.

[15]. Dixon, R. A., Xic, D. Y. and Sharma, S. B. (2005). "Proanthocyanidins – a final frontier in flavonoid research? *New phytologist* 165(1):9-28.

[16]. Doughari, J. H., Elmahmood, A. M., Manzara S. (2007). Studies on the antibacterial activity of root extracts of Carica papaya. L. *Afr. J. Microbial Res.* 1:37-41.

[17]. Facciola, S. (1990). Cornucopia – A source Book of Edible plants. *Kampong Publications* ISBN 0.9628087-0-9.

[18]. Food and Agricultural Organisation/World Health Organization (FAO/WHO) (2002). Vitamin D. In: Human vitamin and mineral requirements. Report of joint FAO/WHO expert consultation. *FAO, Rome:* pp 109-118.

[19]. Harnadez, Y., Lobo, M. G. and Gonzalex, M. (2006). Determination of Vitamin C in Tropical fruits: A comparative evaluation of methods. *Food Chemistry*, 96(4):654-664.

[20]. Idim, V. D. (2017). Analysis of Trace Elements Composition of *Eleusin indica* root and *Carica papaya root. Journal of Science, Engineering and Technology*, 4(2):93-98.

[21]. Igbal, M. and Gnanara, C. (2012). Eleusin indica L. Possesses Antioxidant Activity and precludes carbon tetrachloride (CCI_4) Mediatedoxidative Hepatic damage in rats. *Environ Health Prev. Med.* 17(4):307-315.

[22]. Institute of Medicine, Food and Nutrition Board (1999). Dietary reference intakes: Calcium, phosphorous, magnesium, Vitamin D and fluoride. National academy press, *Washington* DC.
htt://ods.od.nih.gov/factsheets/vitaminD-healthprofessional#hio.

[23]. Institute of Medicine. Food and Nutrition Board (2000). Dietary reference intake for Vitamin C Vitamin E, selenium and carotenoids. National academy press. *Washington, DC.*

[24]. Kaur, G. and Arora, D. (2009). J. BMC complement. *Alter Med.* 9:30. *https://doi.org/10.1186/1472.6882.9.30*.

[25]. Kirkby, H., Kirkby, E. A., Cakmak, I. (1996). Effect of mineral nutritional status on shoot-root partitioning of photoassimilates and cycling of mineral nutrients (PDF). *Journal of Experimental Biology,* 47(S1255):1255.

[26]. Kiruba, S., Machesh, M., Paul, Z. M. and Jeeva, S. (2011). *Asian pac. J. Trop. Biomed*. 1(1):129-130. *https://doi-org/10.1016/52221-1691(11)60139.1*.

[27]. Kulip, J. (1997). A preliminary survey of Traditional medicinal plants in the West Coast and interior of Sabah. *J. Trop for Sci.* 10(2):271-274.

[28]. Kunle, G. (1984). Plant for Human Consumption. Koeltz Scientific Book. An excellent book for the dedicated. A comprehensive listing of latin names with a brief list of edible parts.

[29]. Lim, T. K., (2016). *Eleusin indica*. In Edible Medicinal and Non-medicinal plants. *Springer, charm*. 11:228-236.

[30]. Lim, Y. Y., Lim, T. T. and Tee, J. J. (2007). Antioxidant properties of several tropical fruits: A comparative study. *Food Chemistry*. 103(3):1003-1008.

[31]. Mahdavi, D. C. and Salunkhe, D. K. (1995). "Toxicological aspects of food antioxidant", in Food antioxidants. Mandavi, D. L., Deshpande, S. S. and Salunkhe, D. L., Eds. *Mercel Dekker, New York, NY, USA.* 267-293.

[32]. Matsui, H., Shimosawa, T., Uetake, Y., Wang, H., Ogura, S., Kancko, T., Liu, J., Ando, K., and Fujita, T., Liu, J., Ando, K. and Fujita, T. (2006). Protective effect of potassium against the Hypertensive Cardiac dysfunction: Association with reactive oxygen species reduction. *Hypertension*, 48(2)225-231.

[33]. Newnham, D. M. (2001). Asthma medications and their potential adverse effects in the Elderly: Recommendation for prescribing. *Drug Saf.* 24(14):1065-1080.

[34]. O' Donnell, M. J., Yusuf, S., Mente, A., Gao, P., Mann, J. F., Teo, K., McQueen, M., Sleight, P., Sharma, A. M., Dans, A., Probstfield, J. and Schmieder, R. E. (2011). Urinary sodium and potassium excretion and risk of cardiovascular events. *JAMA*. 306(20):2229-2238.

[35]. O' Shaughnessy, K. M. (2006). Role of diet in Hypertension Management. *Curr Hypertens Rep.* 8(4):292-7.

[36]. Otsuki, N, (2010). Aqueous extract of Carica papaya leaves exhibits Antitumor. *J. Ethnopharmacol.* 127(3):760-767 doi:10.1016/J.jep2009.11.024 Epub.

[37]. Perazella, M. A. (2000). Trimethoprim-induced Hyperkalaemia: Clinical data, mechanism, prevention and management. *Drug saf.* 22(3):227-36.

[38]. Regmi, P. R., Devkota, N. R. and Timsina, J. (2004). Re-growth and nutritional potentials of *Eleusin indica* (L.) Gaertn. (Goose Grass). *J. Inst. Agric. Anim. Sci*. 25:55-63.

[39]. Rice-Evans, C. (2004). "Flavonoids and Isoflavones: absorption, metabolism and bio-activity". *Free Radical Biology and Medicine,* 36(7)827-828.

[40]. Setiawan, B., Sulaeman, A., Giraud, D. W. and Driskell, J. A. (2001). Carotenoid content of selected Indonesian fruits. *Journal of Food Composition and Analysis* 14(2):169-176.

[41]. Shaikh, H., Faisal, M. S. and Mewawalla, P. (2019). Vitamin C deficiencies: Rare causes of severe anemia with hemolysis. *International Journal of Hematol,* 109(5):618-621.

[42]. Skinner, H. C. W. (2005). "Biominerals" *Mineralogical Magazine* 69(5):621-641.

[43]. Usher, G. (1974). A Dictionary of plants used by man. *ISBN* 0094579202.

[44]. Wall, M. M. (2006). Ascorbic acid, vitamin A and Mineral Composition of banana (Musa sp.) and papaya *(Carica papaya)* cultivars grown in Hawaii. *Journal of Food Composition and Analysis.* 19(5):434-445.

[45]. Zainol, M. K., Abd-Hamid, A., Yusof, S. and Muse, R. (2003). "Antioxidant Activity and total phenolic compounds of leaf, root and peptiole of four accessions of centella asiatica (L) *Urban Food Chemistry:* 81:575-581.

[46]. Zhang, Z., Chang, O., Zhu, M., Huang, Y., Ho, W. K. K. and Chen, Z. Y. (2001). "Characterization of antioxidants present in hawthorn fruits". *Journal of Nutritional Biochemistry.* 12(3):144-152.

IDIM, V. D. "Mineral Elements, Proximate and Vitamin Profiles of Mature Goose Grass (Eleusin Indica) And Pawpaw (Carica Papaya Roots)." *IOSR Journal of Biotechnology and Biochemistry (IOSR-JBB),* 7(5), (2021): pp. 01-08.