JOPAT Vol 21(1), 772 - 782, Jan – June. 2022 Edition

ISSN2636 - 5448 https://dx.doi.org/10.4314/jopat.v21i1.4

NUTRITIONAL COMPOSITION OF *Phragmanthera incana* (SCHUM) LEAVES SELECTED FROM FOUR HOST TREES

Adeyemi Maria Modupe[1] and Osilesi Odutola.O.[2]
[1]Department of Chemistry and Biochemistry, Caleb University, Imota Lagos.
[2]Department of Biochemistry, Benjarmin Carson Snr. School of Medicine, Babcock University Remo Ogun State

ABSTRACT

Phragmanthera incana (Schum) belonging to the family *Loranthaceae*, is a specie of mistletoe commonly found on trees in South-western part of Nigeria. They are hemi-parasitic plants that grow on trees which have been employed ethno-medicinally to treat several disease conditions. This study therefore evaluate the dietary and nutritional composition of the plant. Fresh leaves of *P. incana* from four host trees; *Psidium guajava* (guava), *Cola acuminata* (kolanut), *Anacardium occidentale* (cashew), and *Mangifera indica* (mango) trees were collected from its natural habitat. Proximate and mineral analysis were carried out according to recommended methods of the Association of Official Analytical Chemists (AOAC). Triplicate readings of data obtained were presented as mean and standard deviation. The proximate analysis of the powdered samples of *P. incana* leaves showed that the samples contain varying amounts of moisture, ash, crude protein, crude fat, crude fibre, carbohydrate and minerals The carbohydrates and protein contents obtained in the leaves falls within the recommendation values of Food and Nutrition Board of Institute of Medicines (IOM) at 45% to 65% of energy and 10% to 35% of energy respectively. Comparing the results obtained with permissible limits set by WHO for consumed medicinal herbs, it can be concluded that the essential metals and heavy metals present in *P. incana* from the four host trees were below permissible limits. *P. incana* leaves are rich sources of dietary elements essential for biochemical processes and body metabolism.

Keywords: Mistletoes, *Phragmanthera incana*, Proximate, Minerals, Nutrients

*Corresponding author email: docmaryadeyemi@gmail.com

INTRODUCTION

Mistletoe widely known as "cure all" and "all heal" are hemi parasitic plants which belongs to the polyphyletic group [1]. They represent a family of plant species with structural diversity and untapped reservoir of novel compounds for drug discoveries [2]. They obtain their nutrients and structural supports from the host trees they are hemi-parasitic on. Mistletoes are of the families of *Loranthaceaeae* and *Viscaceae*. Most genera of African/Nigerian mistletoes belong to the family *Loranthaceae* [3]. Mistletoe was described as "an all-purpose herb" due to its vast ethno-medicinal usage, which include; antihypertensive, antidiabetic, antispasmodic, diuretic agents and in the treatment of headache, infertility, epilepsy, menopausal syndrome, rheumatism, hyperlipidemia and general well-being [3-5].

Phragmanthera incana (Schum) belongs to the family of *Loranthaceae*, a specie of mistletoe found growing on trees mostly in South-Western part of Nigeria [5]. *P. incana* is a woody hemi-parasitic plant, with stems up to 2 m long; its young parts are densely covered with brown hairs and the berries are red in color. It is found in secondary jungle and bush savanna area; from Sierra Leone to West Cameroon and Fernando Po Island (Gulf of Guinea that forms part of Equatorial Guinea), and extending across the Congo basin to Zaire, Angola and Nigeria [6]. The plant is very variable in form, common and widely distributed. It is locally referred to as "Afomo", in Yoruba "Kauchin", in Hausa and "Awuruse", in Igbo. Its taxonomy kingdom is Plantae, *division*: Tracheophyta, *subdivision*: Spermatophytina, *class*: *Magnoliopsida, order: Santalales, family: Loranthaceae, genus: Phragmanthera, species: incana* and *botanical name: Phragmanthera incana.* Phytochemical analysis showed that chemical constituents such as flavonoids, terpenoids, alkaloids, saponins, tannins anthraquinnones and cardenolides are present in the leaves [6]. Despite its medicinal and forkloric use, little or no report is known about its nutritional value hence the need to determine the proximate and mineral compositions of *P. incana* growing on guava (*Psidium guajava*), kolanut (C*ola acuminata*), cashew (*Anacardium occidentale*) and mango (*Mangifera indica*) trees.

MATERIALS AND METHODS

Materials Used

The materials used includes fresh leaves of *Phragmanthera incana* leaves and Salts such as Nitric acid, Zinc chloride, Calcium chloride, Ferric sulphate, Lead chloride, Copper nitrate, Cadium nitrate, Maganese chloride, Magnesium chloride, Potassium chloride, Chromium chloride. All chemicals used were of pure analytical grade.

Collection of plant material

Fresh leaves of *P. incana* from four host trees; *P. guajava* (guava) tree, *C. acuminata* (kolanut), *A. occidentale* (cashew), and *M. indica* (mango) trees were collected from its natural habitat at a local farm at Imota in Ikorodu local government area of Lagos state Nigeria. It was identified and authenticated at Forest Research Institute (FRIN) Ibadan Nigeria.

Preparation and extraction of plant material

The leaves were washed in a clean tap water to remove debris and contaminants. They were air dried under shade separately for one week. The dried leaves were pulverized using mechanical grinder and stored in an air tight container until further use. Eighty grams of pulverized samples was weighed and macerated in 70% methanol at ratio 1 to 6 w/v for 48 hours. It was shaken intermittently and filtered using Whatman filter paper 1. The filtrate was concentrated using rotary evaporator at 40 ºC to obtain the methanol extract. The extract was stored at 0 ºC until further use.

Determination of proximate composition

Proximate analysis were carried out according to recommended methods of the Association of Official Analytical Chemist (AOAC). The determination of moisture, ash, crude lipid and crude fibre content were determined as outlined in AOAC [7]. Carbohydrate content was calculated by carbohydrate difference: the sum total of moisture, fat, protein, and ash content of each part of the samples were subtracted from 100 as follows:

Carbohydrate content = 100 - (protein %) + moisture (%) + fat (%) + ash (%).

Element Analysis using Atomic Absorption Spectroscopy (AAS)

The following elements were measured using Atomic absorption spectroscopy (AAS) : Calcium (Ca), Potassium (K), Sodium (Na), Magnesium (Mg), Iron (Fe), Cobalt (Co), Copper (Cu), Zinc (Zn), Manganese (Mn), Iodine (I), Chromium (Cr), Cadmium (Cd), Lead (Pb) and Nickel (Ni) according to AOAC [7] as described by Amah et al., 2017 [8]. AAS is a spectro-analytical procedure for the qualitative determination of chemical elements using the absorption of optical radiation (light) by free atoms in the gaseous state, a technique used for determination of a particular element concentration (analyte) in the sample to be analysed.

Triplicate readings of data obtained were analysed using analysis of variance ANOVA and presented as mean and standard deviation (SD) using IBM Social Package Statistical Software (SPSS) version 21.

RESULTS AND DISCUSSION

Adequate nutrition is essential for good health which can be obtained via consumption of nutrients from different foods [8, 24]. General function of these nutrients includes energy building materials for body structures, regulation and control of body processes. [9, 10]. The proximate composition of *P. incana* leaves indicated that the four host trees (Guava, Kolanut, Cashew and Mango) are good sources of carbohydrates and protein; especially *P. incana* from Cashew and Guava trees as shown in Table I. The carbohydrate and protein present may be a conglomerate of bioactive sugars, glycoproteins or proteins which gives the leaves their medicinal potency against certain diseases.

All the host trees are low in crude fat (Table 1) however, the highest amount was found in *P. incana* from Kolanut tree. Crude fibre composition was highest in *P. incana* from Guava tree and lowest in *P. incana* from Kolanut tree. The presence of fibre in all the selected host trees is beneficiary to human body function. Dietary fibre is important for lowering blood cholesterol and blood sugar which is known to reduce the risk of diseases such as hypertension, diabetes, obesity and gastrointestinal disorder. The levels dietary fibre observed in the leaves is beneficial because it could provide the buck necessary for proper peristaltic action, aids the absorption of trace elements in the gut and reduces cholesterol absorption [11, 12]. The food and Nutrition Board of the Institute of Medicines (IOM), America recommendations for Carbohydrates is 45% to 65% of energy, 10 to 35% for Protein and 20% to 35% of energy for fat [13, 14]. They also recommend 14 grams of fibre for each 1000 calories [15]. The ash content of the sample was relatively high indicating its richness in mineral nutrients. There was no significant difference ($p > 0.05$) in the levels of crude carbohydrates, protein and fat in the host trees analysed.

Table I: Proximate composition of methanol extracts of *P. incana* leaves

	PIPG	PICA	PIAO	PIMI	IOM recommendations
Carbohydrates %	73.08 ± 0.35	71.04 ± 0.09	67.84 ± 0.31	69.25 ± 0.50	45 – 65 % of energy
Crude Protein %	10.69 ± 0.06	10.76 ± 0.66	11.49 ± 0.40	9.27 ± 0.62	10 – 35% of energy
Crude Fat %	0.59 ± 0.03	0.88 ± 0.04	0.84 ± 0.02	0.77 ± 0.03	20 – 35% of energy
Crude Fibre %	6.00 ± 0.44	2.40 ± 0.11	3.01 ± 0.82	3.61 ± 0.48	14 g of each 1000 calories
Moisture %	7.32 ± 0.56	10.0 ± 0.29	10.71 ± 0.66	10.07 ± 0.71	-
Total Ash %	2.32 ± 0.56	4.91 ± 0.38	6.14 ± 0.84	7.03 ± 0.90	-

Values are expressed as Mean ± SD

PIPG (P. incana from *Psidium guajava) PICA (P. incana* from *Cola acuminata) PIAO (P. incana* from *Anacardium occidentale) PIMI (P. incana* from *Mangifera indica)*.

P incana growing on different hosts contain different quantities of mineral cations relative to the individual hosts, previous studies indicated that *P. incana* is host specific having similarities with the chemical compositions of the leaves of the host plants (Cocoa, kolanut and bush mango) with slight differences with respect to individual host trees [5].

Macro elements analysis of *P. incana* shows that the four host trees (Guava, Kolanut, Cashew and Mango) are abundance in macro elements as shown in figure 2 and 3. Calcium was highest in *P. incana* from cashew tree and lowest in *P. incana* from Mango tree. Calcium helps builds and maintains bones and teeth. They act as a membrane stabilizer, releases neurotransmitters, enhances function of protein hormones, regulate the heartbeat, maintains muscle tone and controls nerve irritability. Deficiency of calcium leads to rickets, osteoporosis, back pain, indigestion, irritability, premenstrual tension and cramping of the uterus [16]. The daily Recommended Dietary Allowance for Ca is known as 1000 mg day G1 for both male and female ages 19-30 years which is higher than the calcium values obtained in the sample, but it can conveniently supply 32.21% to 19.492% of the daily allowance hence it is a good supplement for people with Ca deficiency.

Magnesium is an activator for enzymes involved in oxidative phosphorylation. They act as a physiological calcium channel blocker and also serve as catalyst in metabolic reactions and co-factor for enzymes. Magnesium amount was highest in *P. incana* from guava tree when compared with the other host trees. They are important in the formation and function of bones, muscles and prevents high blood pressure and depression, muscle contraction, nerve transmission and immune system [17]. They are vital in strengthening cell membrane structure and modulates glucose transport across cell membranes [18]. Studies have indicated that Magnesium supplementation improves insulin sensitivity in diabetic patients and it can improve insulin sensitivity in obese individuals who are at risk of type 2 diabetes mellitus [19]. Sodium is a systemic electrolyte and is essential in co-regulating ATP with potassium. *P. incana* from *A. occidentale* have the highest concentration of Sodium while the highest amount of potassium was seen in *P. incana* from kolanut tree. Potassium is a systemic electrolyte, essential in co-regulating ATP with sodium.

Appreciable amount of dietary trace elements were shown in the four host trees evaluated in varying concentrations as previously reported by Ogunmefun et al., (5) and Adedapo et al., (3).

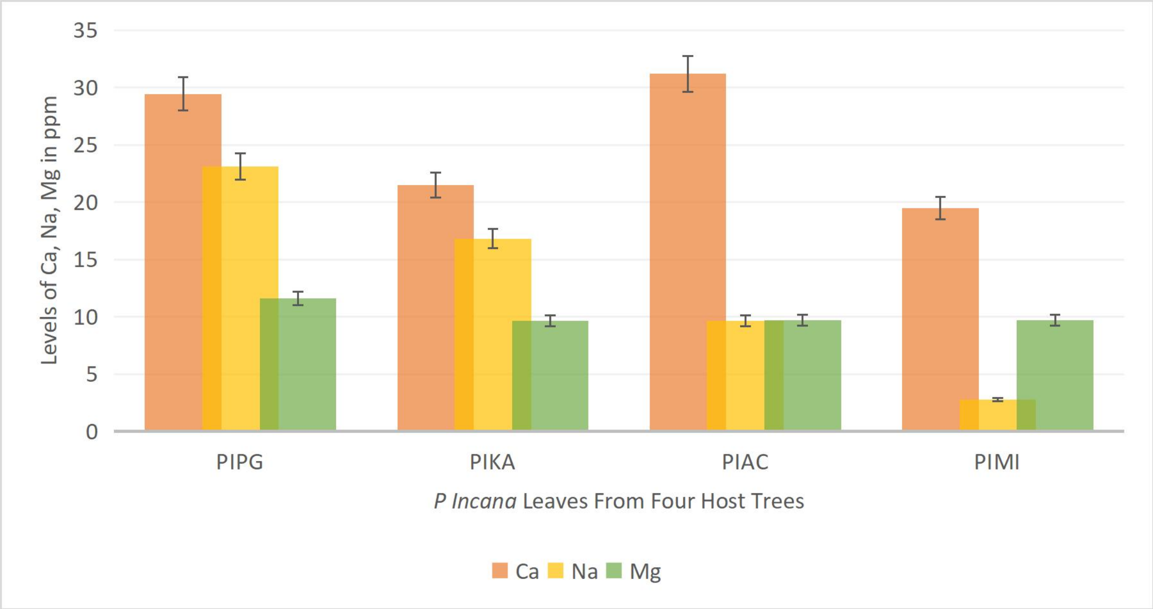

Figure 1: Macro Elements **of *Phragmanthera incana* (Schum) leaves**

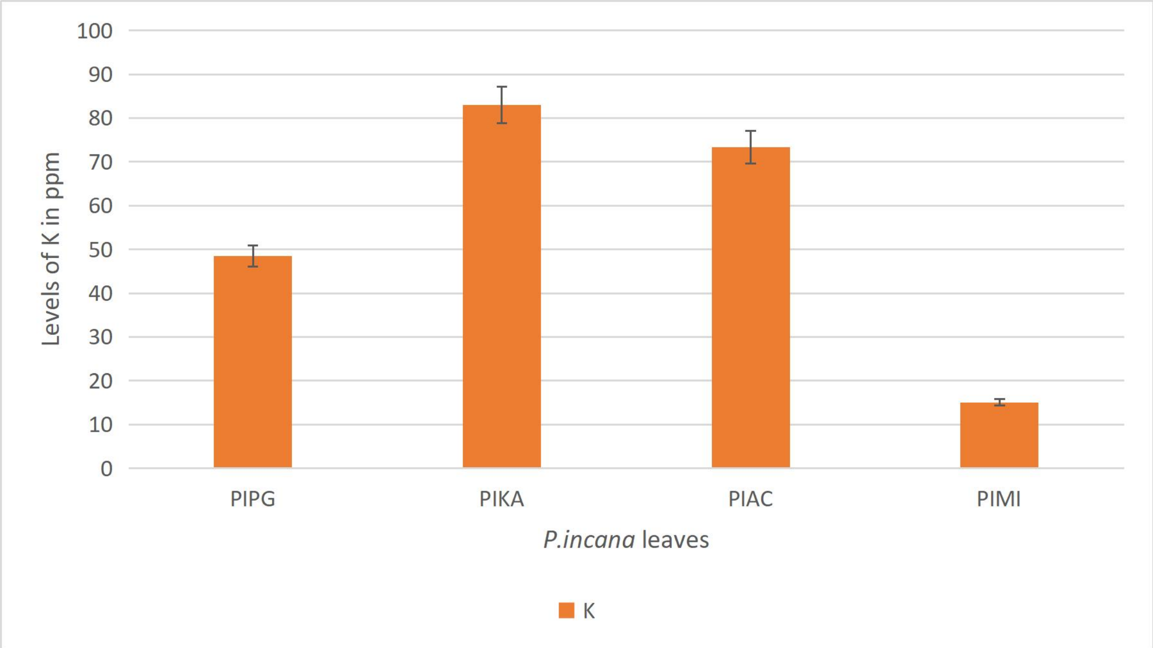

Figure 2: Macro Element **of *Phragmanthera incana* (Schum) leaves**

($p < 0.05$)

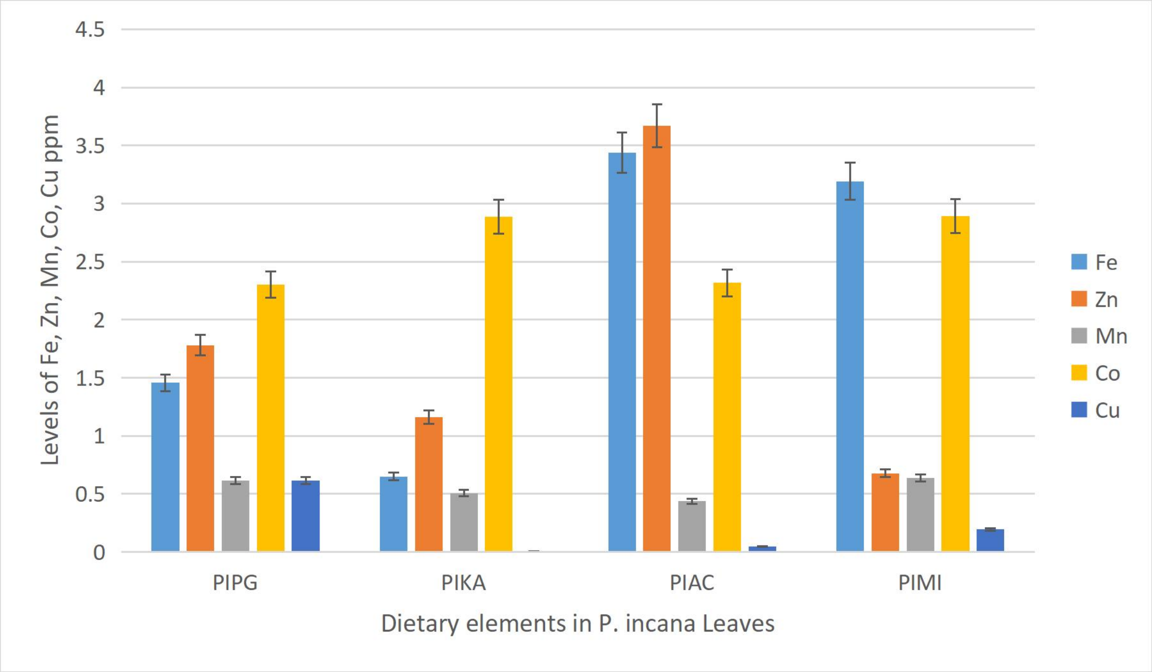

Figure 3: Trace Elements of *Phragmanthera incana* (Schum) leaves
($p < 0.05$)

Table II: Heavy Metals analysis of methanol extracts of *P. incana* leaves

	PIPG	**PICA**	**PIAO**	**PIMI**	**WHO/FAO permissible limits**
Cd (ppm)	ND	ND	0.0005	ND	0.3
Pb (ppm)	0.5024	0.4120	0.974	ND	10.0
Ni (ppm)	0.3122	0.4129	0.1887	0.5410	1.63
Cr (ppm)	0.0776	0.0625	0.0920	ND	2.0

PIPG (P. incana from *Psidium guajava) PICA (P. incana* from *Cola acuminata) PIAO (P. incana* from *Anacardium occidentale) PIMI (P. incana* from *Mangifera indica)*.

***ND - not detected**

The concentrations of Iron varied from 0.6498 to 3.4374 ppm with the highest concentration of Iron (Fe) and Zinc (Zn) found in *P. incana* from *A. occidentale*. *P. incana* from *M. indica* was highest in manganese while *P. incana* from guava tree possess the highest amount of copper. Iron is a major component of hemoglobin and a carrier of oxygen in the blood. Fe is important in tendon and ligament formation and also needed for energy metabolism [20]. Deficiency of Fe causes anaemia, weakness, depression, poor resistance to infection and in women may cause infertility and hence *P. incana* leaves can be a good source of Fe for people with fertility challenges and other Fe deficiency crisis. Zn is a cofactor needed for making protein and genetic material, it has a function in taste perception, wound healing, normal fetal development, production of sperm, normal growth and sexual maturation, immune system health. Copper serves as co-factor for enzymes such as cytochrome oxidase, lysyl oxidase and ceruloplasmin, it is needed for Fe metabolism in the blood [17]. Manganese acts as a cofactor of several enzymes involved in metabolic processes necessary for the skeletal development, reproductive function and growth, oxidative phosphorylation enzymes whose activity increases insulin secretion [21, 22].

The heavy metal composition as represented in Table II shows that Cadmium was not detected in *P. incana* leaves from guava, kolanut and mango tree. It was detected in *P. incana* leaves from cashew at 0.0005ppm. The maximum permissible limit of cadmium in consumed medicinal plants is 0.3ppm. From the results obtained in this study, all the concentrations were below the WHO [23] limits. Nickel concentration varied from 0.188 – 0.541ppm with the highest concentration in *P. incana* from mango tree. The maximum permissible limit of nickel in consumed medicinal plants is 1.5mg/kg, while its routine requirement for humans is 1 mg/day. From the results obtained in this study, all the concentrations were below the WHO limits. Chromium concentration varied from 0.0625 – 0.0920 from *P. incana* from cashew, kolanut, guava but not detected in that of mango. The maximum permissible limit of chromium in consumed medicinal plants is 2 ppm. From the results obtained in this study, all the concentrations were below the WHO limits. Lead concentration varied from 0.412 to 0.947 in *P. incana* from guava, cashew and kolanut but not detected from *P. incana* from mango tree. The maximum permissible limit of lead in consumed medicinal plants is 10ppm. From the results obtained in this study, all the concentrations were below the WHO limits [24]. There was no significant difference ($p > 0.05$) in the metal compositions of *P. incana* leaves from the four selected host trees.

CONCLUSION

P. incana leaves from the four trees exhibit some form of nutritional values needed for plant to be regarded of therapeutic use. *P. incana* leaves are rich sources of macro and dietary elements essential for biochemical processes and body metabolism. The findings in this study reveals that the specie could be used to increase the immune function due to its rich mineral and nutrient compositions and hence could be a reason for its use in folkloric medicine.

ACKNWOLEDGEMENTS

The authors would like to acknowledge the support of Mr Abegunde F. a technologist at the department of chemistry and Biochemistry, Caleb University Lagos for his technical assistance.

REFERENCES

1. Nickrent, D. L. (2001). Mistletoe Phytogenetics: Current relationships gained from analysis of DNA sequences. 2001
2. Adeshina, S. K., Illoh, H. C., Johnny, I. I., & Jacobs, I. E. (2013). African mistletoes (Loranthaceae); Ethnopharmacology, chemistry and medicinal values: An Update. *Afr J Tradit Compl Altern Med 2013;* 10 (4): 161– 170.
3. Adedapo A. D., Ajayi, A. M., Ekwunife, N. L., Falayi, O. O., Oyagbemi, A., Omobowale, T. O., & Adedapo, A. A (2020). Antihypertensive effect of *Phragmanthera incana* (Schum) Balle on NG-nitro L-Arginine methyl ester (L-NAME) induced hypertensive rats. *J Ethnopharmacol* 257: 112888
4. Ogunlabi O, Adegbesan B, & Ajani, E. (2014). Hypolipidermic potentials of mistletoe exudates in Monosodium glutamate-induced hyperlipidermia in rats. FASEBJ; 28:1.
5. Ogunmefun, O. T., Fasola, T. R., Saba, A. B., & Oridupa, O. A. (2013). The Ethnobotanical, phytochemical and Mineral analyses of phragmanthera incana (Klotzsch), A species of Mistletoe Growing on Three Plant Hosts in South western Nigeria. *Int J Biomed Sci*; *9* (1): 33-40
6. Ogunmefun, O. T., Fasola, T. R., Saba, A. B., & Akinyemi, A. J. (2015). Inhibitory Effect of *Phragmanthera Incana* (Schum) harvested from Cocoa (Theobroma Cacao) and Kolanut (Kola nitida) Trees on Fe2+ induced Lipid Oxidative Stress in Some Rat Tissues – in vitro. *Int J Biomed Sci; 11* (1): 16-22.
7. Association of Official Analytical Chemists (AOAC). 2005. Official methods of Analysis of the Association of Analytical Chemists International, 18^{th} ed. Gathersburg, MD. USA.

8. Amah, G. H., Adeyemi, M. M., Akamo, A. J., Oyinloye, B E., Aja, J., & Osilesi, O. (2017). Comparative Proximate and Mineral Nutrients Compositions of Friso Gold Wheat®, Cerelac® and Tom Bran as Complementary Foods. *IOSR-JBB,* 3(5): 61-68.
9. Adeshina, A. J., & Akomolafe, S. F. (2014). Nutritional and anti-nutritional composition of Bridelia ferruginea Benth (Euphorbiaceae) stem bark sample*. Int. J. Sci. Res in Knowl,* 2(2): 92-104.
10. Morris, A. L., & Mohiuddin, S.S (2021). Biochemistry, Nutrients. StartPearls Publishing LLC: NBK 554545 PMID: 32119432
11. Ohikena, F. U., Wintola, O. A., & Afolayan, A. J. (2017). Proximate Composition and Mineral Analysis of Phragmanthera capitata (Sprengel) Balle, a Mistletoe Growing on Rubber Tree. *Res J Bot*., *12:* 23-31.
12. Dhingra, D., Michael, M., Rajput, H., & Patil, R.T. (2012). Dietary fibre in foods: A review. *J. Food Sci. Technol., 49:* 255-266.
13. Manore M. M. (2005). Exercise and Institute of Medicine recommendations. *Curr Sports Med Rep*, 4(4): 193-198
14. Lee J. h., Park H. M., & Lee YJ. (2021). Using dietary Macronutrients Patterns to Predict Sarcopenic Obesity in Older Adults: A Represenation of Korean Nationwide Population Based Study. *Nutrients*; 13(11): 4031
15. Madhu, C., Krisha, K.M., Reddy, K.R., Lakshmi, P. J., Kelari, E. K (2017). IOM Recommendations for crude fibre is estimation of Crude fibre Content from Natural Food Stuffs and Its Laxative Activity Induced in Rats. *Int J Pharma Res Health Sci*, 5(3): 1703 - 1706.
16. Hasling, C., Sondergaard K., Charles P & Mosekilde L., (1992). Calcium metabolism in postmenopausal osteoporotic women is determined by dietary calcium and coffee intake. *J. Nutr., 122*: 1119-1126.
17. Shivraj, H. N. & Khobragade, C. N. (2009). Determination of nutritive value and mineral elements of some important medicinal plants from Western Part of India. *J. Med. Plants, 8:* 79-88.
18. Jahnen-Dechent, W. & Ketteler, M. (2012). Magnesium Basics. *Clin. Kidney J., 5*: 3-14.
19. Volpe, S.L. (2013). Magnesium in disease prevention and overall health. *Adv Nutr., 4*: 378S-383S.
20. Gaeta, A. & Hider, R.C. (2005). The crucial role of metal ions in neurodegeneration: The basis for a promising therapeutic strategy. *Br. J. Pharmacol., 146:* 1041-1059.

21. Lee, S. H., Jouihan, H. A., Cooksey, R. C., Jones, D., Kim, H. J., Winge, D. R., & McClain, D. A. (2013). Manganese supplementation protects against diet-induced diabetes in wild type mice by enhancing insulin secretion. *Endocrinology,* 154*:* 1029-1038.
22. Zablocka-Slowinska, K. & Grajeta, H. (2012). The role of manganese in etiopathogenesis and prevention of selected diseases. Postepy. *High. Med. Dosw., 66*:549-553.
23. World Health Organization, (2006). Guidelines for Assessing Quality of Herbal Medicines with Reference to Contaminants and Residues, World Health Organization, Geneva, Switzerland, pp. 107.
24. World Health Organization, (2020). Healthy Diet, Facts Sheets, World Health organization, Geneva, Switzerland.