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Assessment of the Nutritive Properties of Tuber and Leaf of Raphanus Sativus Grown In Nigeria.

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ABSTRACT
Raphanus sativusis a vegetable that offers numerous health benefits and plays valuable roles in balanced diets. Literature on the nutritive components and active pharmaceutical agents in red Raphanus sativus grown in Nigeria is limited. Therefore this research is aimed at assessing the nutritive properties of leaf and tuber of red Raphanus sativus grown in Nigeria.
Samples were collected from a vegetable farm in Akinyele Area in Ibadan, Oyo State, Nigeria, and were analyzed for proximate, mineral and phytochemical (secondary metabolites) compositions in both the leaf and tuber and standard methods of analysis were used.
Proximate analysis revealed that the moisture contents were; 85.52% leaves, 88.71% tubers, crude protein; 5.09% leaves, 1.10% tubers, crude fat (2.00% leaves, 2.77% tuber), crude fibre (1.02% leaf, 2.35% tuber), ash content (1.34% leaf, 1.01% tuber), carbohydrate (5.03% leaf, 4.05% tuber).
Mineral analysis showed that the sample contained the following minerals;zinc(8.13mg/kg leaf, 4.85mg/kg tuber), iron (3.87mg/kg leaf, 2.64mg/kg tuber), manganese (3.42mg/kg leaf, nil tuber), sodium (2.146mg/kg leaf, 3.16mg/kg tuber), calcium (0.75mg/kg leaf), copper (0.024mg/kg leaf), potassium (0.25mg/kg leaf, 1.9mg/kg),
Phytochemical screening of the leaf extract in percentage weight revealed the presence of; alkaloid (14.75% leaf, 16.65% tuber), terpenoid, (2.35% leaf, 1.60% tuber), saponin (2.35% leaf, 2.60% tuber), and flavonoid (3.16% leaf, 1.56% tuber).
The finding from this study suggests that radish could be served as food or taken as herbal medication. The local radish also contained the chemical composition found in the foreign ones according to published reports. Radish is also a foreign vegetable to Nigeria in order to create awareness and acceptability in the medicinal, pharmaceutical nutraceuticals industries. This research work being the first one reported in Nigeria.
Keywords: Raphanus sativa, proximate, mineral, phytochemical, nutraceutical

I. INTRODUCTION

The vegetable Radish (Raphanus sativus), though uncommon in some communities, is cultivated and eaten in several parts of the world and is regarded as a staple of the human diet. Typically, radishes are consumed raw as a crunchy

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vegetable, mostly in salads, though they are also commonly used in various Asian and European recipes. Some people in the Middle East, like drinking its juice extract in an effort to reap specific health advantages. Radish is linked to Brassica Rapa and is a member of the Brassicaceae family.Raphanus sativus is a vegetable crop that has been found to significantly contribute to the global economy, particularly in East Asia. Its long history of domestication, development, and breeding has resulted in a wide range of land races and traditional varieties which differ greatly in terms of root size, shape, colour, and flavour. Other traits include harvest and bolting dates. While some cultivars are utilized as leafy vegetables, or oil crops, the thick roots of radish are frequently collected as vegetables. The plant's root is also used to treat a variety of illnesses in Africa, including gastrointestinal problems, diabetes, hepatitis, and gall bladder problems (Chaturvedi, 2008).Radish has also been reportedly to have health benefits (Takaya et al., 2003). Since ancient times, radishes' extracts have been used in folk medicine to treat ulcers, hepatic inflammation, constipation, urinary infections, stomach issues, and constipation (Goyeneche et al., 2015). Radishes also possess antibacterial (Beevi et al., 2009; Rakhmawti et al., 2009), anticancer (Pocasap et al., 2013), antioxidant (Kim et al., 2017), and anxiety-relieving (Siddiq et al., 2018) effects, according to numerous reports. Majority of researchers considered that wild radish (R. raphanistrum L.) was the source of cultivated radish (R. sativus L.), while some hypothesized that R. sativus was created through cross-pollination between R. maritimus and R.landra (Kaneko et al., 2007). Radish is used as a common domestic cure in Unani, Greeko-Arabic, and Indian traditional medicine to treat a variety of illnesses, including jaundice, gallstones, liver conditions, rectal prolapse, indigestion, and other gastrointestinal symptoms (Being et al., 2005; Shukla et al., 2011). In general, radish contains dietary fibres, protein, sugars, carbs and even a little amount of fat and fluoride (Khattak et al., 2011). Also, It contains a variety of minerals (calcium, iron, magnesium, manganese, zinc, potassium and phosphorus) as well as water-soluble vitamins (Khattak et al., 2011). This study was designed to assess the nutritive values of Nigerian grown red radish comparing the nutrients,

II. MATERIALS AND METHODS

Sample collection

Fresh leaves and tubers of Raphanus sativus plant were collected from a farm in Akinyele Local Government Area, Ibadan, Oyo state, Nigeria.

Sample Identification

The collected plant samples were taken to Forestry Research Institute, Ibadan, Oyo State, Nigeria for identification. The plant materials were duly authenticated as Red Raphanus sativus by the institute with voucher number FHL 113440.

Sample Preparation

The leaves of red Raphanus sativus were sorted, cleaned, weighed and air-dried at room temperature (26 °C) for two weeks. It was then pulverised to a consistent powder and weighed. Also, the tubers of Raphanus sativus were chopped to tiny particles with a local plastic grater before being oven dried at 56 °C for 6 h. The dried samples were then crushed exhaustively to obtain a uniform powder and then weighed. Both the leaves and tubers were weighed before drying to determine the water content, the two dried powders were divided in to two samples each, one part was kept for some analysis, and labeled as leave dried sample and tubers dried sample respectively while the other parts were used for extraction.

Extraction of Plant Materials

Extractions were done using absolute ethanol, each of the two samples were soaked for 72 h in the solvent at room temperature. The filtrates were then separated from residue using a whatman No1 filter paper. After that, they were concentrated with the aid of a rotary evaporator and then stored in airtight plastic containers and labeled. The extracts were then kept in a refrigerator for prior to further analysis.

Proximate analysis

Moisture contents weight were determined by drying to constant weight at 105^{0}C in an oven, ash contents by ignition at 550^{0}C in a muffle furnace for 4 h, oil content by soxhlet extraction with n-hexane as solvent, protein by the Kjeldahl method, and crude fibre by the acid and alkaline digestive methods all described by Ayoola and Adeyeye (2010) . The carbohydrate contents were estimated by difference. Subtracting the sum of water, protein, fat, crude fibre and ash percentage from one hundred (AOAC, 2006).

Mineral analysis

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The mineral compositions were determined by digesting the ash with 3M hydrochloric acid and using the atomic absorption spectrophotometer for manganese, zinc, iron while flame photometer was used for calcium, sodium, potassium, phosphorus and magnesium ( ).

Phytochemical Analysis

The qualitative and quantitative analysis of the secondary metabolites was determined using the standard method described by Krishnaiah et al (2009) and Bargah (2015).

Statistical Analysis

The results were determined as the mean standard errors (SEs) of three parallel readings after each experiment were completed in triplicate. Graph Pad Prism 6 was used to conduct a two-way analysis of variance (ANOVA) and Tukey test of multiple comparisons on significant differences between samples. Statistics were judged to be significant for p values under 0.5. Using MS Excel 2010, the linear regression equation was analyzed to ascertain the IC50 values.

III. RESULTS AND DISCUSSION

Proximate Composition

Table 1 shows the proximate compositions of both the tuber and the leaf of Raphus sativa. The moisture content in both the Radish leaves and tuber were85.52% and 88.71% respectively.

The ash content ranged between 1.34% for the leaves and 1.01% for the tuber respectively, this is slightly lower than what was reported by Goyenechi et al. (2015). The percentage ash content gives an insight to the inorganic and mineral contents of Radish sativa (Luo et al., 2018). The ash content in the Chinese varieties range from 0.11 – 0.09%, which indicates that the Nigerian grown red Radish has higher inorganic compound than that of the foreign. This can be attributed to mineral element present in the soil where the radish was cultivated.The crude fibre content of the red Radish leaves and tubers ranged from 1.02 – 2.35%, the tuber has the higher value than the leaves. This indicates that the red Radish is a highly digestible vegetable which can be useful for people on diet for weight loss and people with digestive tract problems. The result shows lower fibre content than the previous works already done by Geyeneche et al., 2015 and Luo et al., 2018. Fibre helps in the maintenance of human health and helps to lower cholesterol levels. Consequently the use of Radish in salad recipes and soups aids digestion. Radish can be effective as anti-constipation and lowering of cholesterol level in the blood. This may also lower various cancers growth and bowel disease. Furthermore, the presence of high fibre content in a vegetable improves glucose tolerance and this can be beneficial in treating diabetics (Eromosele&Eromosele 1993). The crude fat in red Radish ranges from 2.10% - 2.77% for tuber and leaves respectively. Most plants investigated have low lipid profile or crude fat. However, the value of crude fats found is high compared to previous works. Plant lipid is good for health because they have low density lipid. Crude protein ranges between 5.09% and 1.10%. The leaves have higher protein content than the tuber. The presence of a high amount of protein in red Radish makes it a good food. It is a good source of protein for the vegetarian and required for body building, repair and many metabolic and enzymatic activities in the body system. Total carbohydrate ranged between 5.03% and 4.06% with the leaves having the highest amount. Carbohydrate makes good for people following a low calorie diet.

Mineral Compositions

Table 2 shows the lists of minerals found in the leaves and tubers, these ranged between 0.24% -0.059% for Chromium, 8.135% - 4.85% for Zinc. The study revealed that the phosphorus values in red Radish ranged from 2.1 mg in the tuber to 1.9 mg in the leaves. Low levels of phosphorus have been found to be beneficial to people having kidney challenges. It has also been found to be good for backbone and teeth formation. Red Radish is low in Phosphorus which makes it a good vegetable for dialysis patients and bone support.Red Radish was found to be rich in calcium. Table 2 shows that the calcium values in Red Radish ranges from 0.75 g in tubers to 0.87 g in leaves. Calcium is good for the bone as it strengthens the bone. It also helps in blood clotting and assists in nerve impulse transmission. Another mineral found in red Radish is Sodium. The study revealed that the values for Sodium found in red Radish ranges from 2.146 g in the tubers to 3.167 g in the leaves. Sodium is a vital nutrient that plays essential role in many body functions. It is required to conduct nerve impulses, contraction and relaxation of muscles. It further helps to maintain proper balance of water and nutrients. The fact that a high percentage of Sodium is present in red radish indicates that it is good for improving many body functions.Magnesium is one of the minerals

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tested for in this study. The test revealed that red Radish tubers contained 0.238 mg while the leaves had 0.429 mg. Magnesium has several uses such as blood pressure regulation, energy production and synthesis of bio- molecules. It is also useful in the transportation of ion, improvement of sleep quality and anti-inflammation. Table 2 shows that the Magnesium values seem high when compared to the WHO safe value. However they can still be considered as reasonable because it aids enzyme function and very good for the heart.

Iron values found in red Radish were found to be 3.870 mg in the tubers and 2.640 mg in the leaves. Iron is a major component in the hemoglobin, thus inadequate amount in the body can lead to anemia. It is also useful for immunity and respiratory function. Chromium is required for regulation of glucose uptake into the cells. Studies have revealed that men need to ingest about 35 g while women need to ingest about 25g of Chromium to effectively regulate glucose uptake into the cells. The results obtained indicate that red Radish if consumed in sufficient quantity can help to regulate glucose uptake into the cells. Consequently Radish consumption could be helpful for diabetics.Copper is another mineral found in red Radish. The test for Copper revealed that the amount present in red Radish leaves was 0.059 mg while the tuber was lower with 0. 024 mg. Copper functions in enzymes as a catalyst, therefore it participates in many metabolic activities.

Zinc presence in red Radish revealed that 8.135 mg was found in the tuber, while 4.849 mg was found in the leaves. This shows that Zinc is the most abundant trace mineral element present in red Radish. Zinc affects all body processes hence it is considered to be very vital to humans. It has been found to act directly and indirectly in enzyme functions. Manganese was also found to be present in red Radish. The values obtained revealed 0.238 mg in the tuber and 0.429 mg in the leaves. Manganese has been found to help the connective tissues of the body, bones and blood clotting. It also plays a role in sex hormones, fat and carbohydrate metabolism.

The qualitative estimates of secondary metabolites were conducted using absolute ethanol as the extracting solvent. The screening conducted was for alkaloids, flavonoids, saponin and tannin. phenol, terpenoid and steroids were also conducted Table 3. Alkaloids are natural occurring organic compound, which often contain at least one nitrogen compound. The ethanol showed the presence of little alkaloid. The tuber showed the presence of small amount of alkaloid in all the extraction. Flavonoid revealed its presence in the extract of ethanol for leaf, but absent in the extract of tuber. Saponin was present in both extracts of ethanol (leaf and tuber). Tannin, phenoland cardiac glycoside were absence in the red radish samples both leaves and tuber. Terpenoid was strongly present in ethanol extract for both leaf and root tuber. Steroid was present in the ethanol leaf and the root tuber.

Quantitative analysis to determine the presence of secondary metabolites was conducted. The weight yield for the leaf was 7.45% while that of tuber was 14.75%. The yield from the ethanol extract for leaf was 16.65% while that of tuber was 14.75%. It was found that the leaf has a higher yield of alkaloids than the tuber. Alkaloids are one of the most efficient therapeutically significant plant substances. Poor isolated alkaloids and the synthetic derivative are used as basic medicinal agent because of their analgesic, antimicrobial and bacterial properties (Stray, 1998). Therefore, the leaf sample and tubers can be used in pharmaceutical industries. Terpenoids are organic compound that have diverse pharmacological activities including antimicrobial, anti-inflammation and anti-oxidant properties. Terpenoid determination for the ethanol extract was 1.6%. while ethanol extract was 2.35% w/w. Saponins are glycosides that are known to have cholesterol-lowering and anti-tumor properties. They help fight ranges of infections, combat viruses and microbes. The results in Table 4.10 showed that Saponin was non-detected in the N-hexane extracts for both leaf and tuber. However, the di-ethyl-ether extract showed 1.55% for leaf sample while the tuber had a yield of 0.5%. The ethanol extracts showed 2.6% yield for leaf and 2.35% yield for tuber.Flavonoids are also polyphenolic compounds that have wide range of biological activities. These activities include anti-cancer and anti-inflammatory properties. However, the ethanol extract for leaf showed 1.56% while that for tuber was 3.16%.

IV. DISCUSSION

Humans can benefit greatly from plant-rich diets in terms of their health. It lowers the risk of many diseases, including cancer, cardiovascular disease, neurological disorders, and aging-related issues. Additionally, plant-based diets provide an abundance of antioxidants, which are crucial for preventing the damaging effects of free radicals, which are unavoidable consequences of key

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metabolisms. Different secondary metabolites found in plants are significant from a pharmaceutical perspective. Secondary metabolites are deposited in specialized cells and organelles although are less common and distributed than primary metabolites (Rhodes,1994).

A well-known root vegetable crop from the Brassicaceae family is the radish (Raphanus sativus L, 2n = 18). Due to the excellent nutritional content of radishes, which have been reported by many researchers, its tap roots have been eaten all across the world in pickles, salads, and curries Curtis,2003; (Castro_torres et al., 2014; Goyeneche et al.,2015). In addition to the roots, the usefulness of the leaves and sprouts for nourishment and medicine has also been noted (Takaya et al.,2003). This work was done to validate the nutritive values of red Raphanus sativus grown in Nigeria. The Tuber and leaf collected were shown to possess many Phytochemicals which include; phenols, terpenoids, saponins, tannin, anthraquinones, flavonoids, cardiac glycosides. According to several studies, Red Raphanus sativus contain glucosinolates and phenolic compounds (Beevi et al., 2012; Castro Torres et al., 2014).

V. CONCLUSION

Red Raphanus sativus was found to possess significant nutritional and pharmacological benefits. These benefits are mostly related to its antioxidant properties. Due to their associated bioactivitie, compounds, red Raphanus sativus extracts could be administered under a variety of pathological situations to aid in the healing of diseases and the avoidance of hazardous maladies. Different red Raphanus sativus parts, including the leaf and tuber contain bioactive compounds which act on a variety of potential therapeutic targets linked to diseases like cancer, inflammation, liver damage, and diabetes. This study conducted a general evaluation of the nutritive values of red Raphanus sativus grown on Nigeria soil dwelling on its Phytochemicals, Proximate, Antioxidant capacity, and important micronutrients as well as Heavy metals Compositions for its leaf and tuber. This study has thus contributed in exposing the huge benefits of Nigerian grown radish which is yet to be a staple food in Nigeria.This study recommends that Nigeria farmers should be sensitised on the huge benefits derivable from growing Raphanus sativus in order to increase its cultivation and make it readily available. It is also recommended that the general public should be given adequate sensitisation on the nutritional benefits of Raphanus sativus in order to increase its consumption.

REFERENCES

[1]. Beevi S.S., Mangamoori L.N., Dhand V., Ramakrishna D.S. (2009). Isothiocyanate profile and selective antibacterial activity of root, stem and leaf extracts derived from Raphanus sativus L. Foodborne pathogens and disease, 6(1), 129–136.

[2]. Castro-Torres I.G., De la O-Arciniega M., Gallegos-Estudillo J., Naranjo-Rodríguez E.B., Domínguez-Ortíz M.Á. (2014). Raphanus sativus L. var. niger as a source of phytochemicals for the prevention of cholesterol gallstones. Phytotherapy research : PTR, 28(2), 167–171.

[3]. Chaturvedi P. (2008). Inhibitory response of Raphanus sativus on lipid peroxidation in albino rats. Evidence-based complementary and alternative medicine: eCAM, 5(1), 55–59.

[4]. Goyeneche R., Roura S., Ponce A., Vega-Galvez A., Quispe-Fuentes I., Uribe E., Di Scala K.(2015). Chemical characterization and antioxidant capacity of red radish (Raphanus sativus L.) leaves and roots. Chemistry, Environmental ScienceJournal of Functional Foods, 16, 256–264.

[5]. Kaneko T., Makimura, K., Abe, M., Shiota, R., Nakamura, Y., Kano, R., Hasegawa, A., Sugita, T., Shibuya, S., Watanabe, S., Yamaguchi, H., Abe, S., & Okamura, N. (2007). Revised culture-based system for identification of Malassezia species. Journal of clinical microbiology, 45(11), 3737–3742. (2007)

[6]. Khattak K.F. (2011). Nutrient composition, phenolic content and free radical scavenging activity of some uncommon vegetables of Pakistan. Pakistan journal of pharmaceutical sciences, 24(3), 277–283.

[7]. Kim J., Ahn M., Kim S.E., Lee H.S., Kim H.K., Kim G.O., Shin T. (2017). Hepatoprotective effect of fermented black radish (Raphanus sativus L. var. niger) in CCl4 induced liver injury in rats. J. Prev. Vet. Med. 41:143–149.

[8]. Luo X., Zhang H., Duan Y., Chen G. (2018). Protective effects of radish (Raphanus sativus L.) leaves extract against hydrogen peroxide-induced oxidative damage in human fetal lung

International Journal of Advances in Engineering and Management (IJAEM)
Volume 7, Issue 01 Jan. 2025, pp: 449-454 www.ijaem.net ISSN: 2395-5252

fibroblast (MRC-5) cells. Biomed. Pharmacother. 103:406–414.
[9]. Pocasap P., Weerapreeyakul N., Barusrux S. (2013). Cancer preventive effect of Thai rat-tailed radish (Raphanus sativus L. var. caudatus Alef) J. Funct. Foods. 5:1372–1381.
[10]. Rakhmawati R., Anggarwulan E., Retnaningtyas E. (2009). Potency of Lobak leaves (Raphanus sativus L. var. Hortensis Back) as anticancer and antimicrobial candidates. Biodivers. J. Biol. Divers. 10
[11]. Rhodes M.J.C. (1994). Physiological roles for secondary metabolites in plants: Some progress, many outstanding problems. Plant Mol. Biol. 24:1–20.
[12]. Shukla S., Chatterji S., Mehta S., Rai P.K., Singh R.K., Yadav D.K., Watal G. (2011). Antidiabetic effect of raphanus sativus root juice. Pharm. Biol. 49:32–37.
[13]. Siddiq A., Younus I. (2018). The Radish, Raphanus sativus L. Var. caudatus reduces anxiety-like 6on-alcoh in mice. Metab. Brain Dis.
[14]. Takaya Y., Kondo Y., Furukawa T., Niwa M. (2003). Antioxidant constituents of radish sprout (Kaiware-daikon), Raphanus sativus L. J. Agric. Food Chem. 51:8061–8066.

RESULTS AND DISCUSSION

Table 1: Proximate Compositions of Leaves and Tuber of Red Radish

S/N	Parameters	Leaves (%)	Tuber (%)
1.	Moisture content	85.52 ± 0.01	88.71 ± 0.01
2.	Crude protein	5.09 ±0.02	1.10 ± 0.002
3.	Crude fat	2.00 ±0.05	2.77 ± 0.6
4.	Ash content	1.34 ±0.001	1.01 ±0.001
5.	Fiber content	1.02 ±0.001	2.35 ± 0.001
6.	Carbohydrates	5.03	4.905
7.	Energy	60.99kj	50.49k j

Values are Means of duplicates

Table 2: Mineral Composition of the Leaves and Tuber

S/N	Minerals	AC(W) mg/kg	AC(X) mg/kg	WHO (Safe level)
1.	Cr	0.048	0.062	1.0
2.	Fe	3.870	2.640	0.3
3.	Zn	8.135	4.849	5.0
4.	Cu	0.024	0.059	1.0
5.	Na	2.146	3.167	5.0

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6.	Mn	3.422	2.679	10
7.	Mg	0.238	0.429	0.1
8.	K	0.25	0,23	5.0
9.	Ca	0.753	0.87	10
10.	P	2.1	1.9	

Values are mean

Table 3: Phytochemical (Qualitative) screening of Secondary Metabolites

Parameter	Ethanol Extract (w)	Ethanol Extract (x)
Saponins	++ve	++ve
Tanins	-ve	-ve
Flavonoids	+ve	+ve
Cardiac glycosides	-ve	-ve
Anthraquinones		
Steroids	+ve	+ve
Terpenoids	-ve	-ve
Alkaloids	++ve	++ve
Phenol	+ve	+ve
	-ve	-ve

Key:
Absent= -ve
Present = +ve
Abundantly present =++ve

Table 4: Phytochemical (quantitative) estimate of secondary metabolites

Sample	% alkaloids content (%w/w)	% flavonoid content (%w/w)	% saponin content (%w/w)	% tannin content (%w/w)	% terpenoid content (%w/w)	% total phenol (%w/w)
Ethanol extract of W	16.65	1.56	2.6	0	1.6	0
Ethanol extract of X	14.75	3.16	2.35	0	2.35	0