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Chemical Composition and Antioxidant Activities of Beetroot Peel.

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ABSTRACT

Proximate, mineral and antioxidant properties of beetroot (*Beta vulgaris*) peel were investigated using standard analytical techniques. Result for proximate revealed that moisture content was 30.88%, ash content (10.58%), crude fat (3.29%), crude fiber (6.98%), crude protein (4.10%) and carbohydrate (44.17%). The mineral composition (mg/g) also showed that sodium was 4.17%, iron (26.46%), copper (0.21%), magnesium (5.91%), potassium (13.82%) and phosphorus (11.57%) while zinc and calcium were not at detectable range of AAS. There was no activity for its antioxidant property. The results obtained from this analysis shows that Beetroot peel is a good source of carbohydrates, protein, ash, fiber, lipid and moisture, it also contained some mineral contents such as copper, phosphorous and iron which are required by the body to function effectively. Its consumption is therefore encouraged instead of regarding it as a waste material.

Keywords: antioxidant, investigation, mineral, peel, proximate

1.0: INTRODUCTION

Vegetables are parts of plants that are consumed by humans or other animals as food.The origi nal meaning is still commonly used and is applied to plants collectively to refer to all edible pla ntmatter**,** including the flowers**,** fruits**,** stems**,** leaves**,** roots, seeds.Vegetables can be eaten eithe r raw or cooked and play an important role in human nutrition**,** being mostly low in fat and carb ohydrates**,** but high in vitamins**,** minerals and dietary fiber**.** Many nutritionists encourage peopl e to consume plenty of fruit and vegetables**,** five or more portions a day often being recommen ded. Vegetables and fruits are strongly coloured because they contain a chemical compound named carotenoids. The complex chemicals in vegetables have a favorable effect on the human body because they provide hydration due to their high water content, regulate metabolism in general, stimulate the muscular and skeletal systems, internal glands, and enzymatic activity, and have high nutritional and energy value. Vegetables contain minerals, mainly K, Ca, Mg, P, and Fe.

Studies on wild edible fruits and vegetables indicate that they are sources of human nutrition since they contain minerals and vitamins that are essential, Aremu *et al.,* (2017).

Peels obtained from vegetables and fruits are considered waste substance and therefore discarded into the environment; some researches on the peels of these fruits revealed the presence of vital phytochemicals which has a wide range of biological activities Khattack & Rahman (2016)

Beetroot *(Beta vulgaris)* is botanically classified as an herbaceous biennial from *Chenopodiaceae* family, It's obtained from beet plant as its tap root. Beetroots can be consumed as vegetable or fruit. It contains very few calories with no fat, thus, a good source of fiber Yashwant (2015). There is growing interest in the use of natural food colors because synthetic dyes are becoming more critically assessed by the consumer. Besides being used as a food (consumed directly), this fruit has uses as a food colorants and as a medicinal plant.

This root has been considered as a nutritional food since early Roman and Greek time for its ability to reduce fevers Sri Vidya NAC and Radhi Sri S. (2018).

Beetroot peel is the outer layer of beetroot itself, there is no research or any analysis carried out on beetroot peel to ascertain its nutritional value and to find out if it is consumable or consuming it has a negative implications.

Evaluating its chemical composition will provide more information about its advantage and usage thereby promoting its application.

1.1: Selected Reviews

Many studies indicate that eating more plant foods, like beetroot, decrease the risk of obesity, overall mortality, diabetes, and heart disease and promote a healthy complexion and hair, increased energy, and overall lower weight. A study carried out in 2008 on Hypertension by *Siervo,. et al., (2013)* examined the effects of ingesting 500 milliliters of beetroot juice in healthy volunteers and found that blood pressure was significantly lowered after ingestion. Researchers hypothesized this was likely due to the high nitrate levels contained in beet juice and that the high nitrate vegetables could prove to be a low-cost and effective way to treat cardiovascular conditions and blood pressure. Researchers at Wake Forest University have found that drinking juice from beetroot can improve oxygenation to the brain, slowing the progression of dementia in older adults. *Siervo, et al., (2013).* Beets contain an antioxidant known as alphalipoic acid, which may help lower glucose levels, increase insulin sensitivity and prevent oxidative stress-induced changes in patients with diabetes. Because of its high fiber content, beetroot helps to prevent constipation and promote regularity for a healthy digestive tract. Choline is a very important and versatile nutrient in beetroot that helps with sleep, muscle movement, learning, and memory. Choline also helps to maintain the structure of cellular membranes, aids in the transmission of nerve impulses, assists in the absorption of fat and reduces chronic inflammation.

2.0: MATERIALS AND METHODS

2.1. Reagents, Apparatus and Equipments.

The chemicals used during the analysis includes Hexane, Sulfuric acid (H_2SO_4), Sodium hydroxide (NaOH), Hydrochloric acid (HCl), Ethanol, Diethylether, Boric acid (H_3BO_3), Nitric acid (HNO_3), Kjeldahl catalyst, DPPH (2,2- diphenyl-1-picrylhydrazyl), Methyl red indicator, Petroleum ether.

These are the apparatus used, conical flask, measuring cylinder, burette, kjeldahl flask, crucibles, tong, beaker, and desiccators, while the Equipment's used are weighing balance, muffle furnace, Soxhlet extractor, hot plate, hot drying oven, Fume board, Atomic Absorption Spectrometer (AAS).

2.2: Collection of Samples

Fresh sample (beetroot) was bought from fruit and vegetable sellers at Farin Gada metropolis in Jos Plateau state.

2.3: Sample Preparation

The beetroot was washed with distilled water to remove all sand and dirt from the sample then rinsed twice. The sample was carefully peeled; the peels obtained were air dried at room temperature for 48 h. After air drying, the sample was made into smaller pieces then taken to the laboratory for analysis.

2.4: Proximate Analysis

The moisture, ash, crude protein (N x 6.25), crude fat, crude fiber and carbohydrate (by difference) were determined in accordance with the standard methods of AOAC (2005). All

proximate analyses of the sample flours were carried out in triplicate and reported in percentage. All chemicals were of Analar grade.

2.5: Mineral Analysis

The standards of Na, Fe, Ca, Cu, Mg, Zn and K solutions of 0.2, 0.4, 0.6, 0.8 and 1.0 mgL^{-1} were prepared from each of the metal solutions of 1000 mgL^{-1} stock solutions. The filtrates of the digested samples were analysed by atomic absorption spectrophotometer (AAS) for Fe, Ca, Cu, Mg and Zn while Na and K were determined using a flame photometer (Corning UK Model 405). The detection limit of the metals in the sample was 0.000 mgL^{-1} by means of the UNICAM 929, London, AAS powered by the solar software. The optimal analytical range was 0.1 to 0.5 absorbance units with coefficient of variation from 0.9% to 2.21%. Phosphorus was determined colorimetrically using a Spectronic 20 (Gallenkamp, London, UK) instrument, with KH_2PO_4.

2.6: Antioxidant Determination

The following Concentrations of the extract were tested (1.0,0.5,0.25,0.125, and0.0625 mg/ ml).

1milliliter of the extract was placed in a test tube and 3ml of ethanol was added followed by 0.5ml of 1mM of DPPH in methanol. A blank solution was prepared containing thesame am ountof methanol and DPPH. The Radical Scavenging Activity was calculated using the follo wing formula:

$$\text{Inhibition (\%)} = \frac{A_b - A_s}{A_b} \times 100$$

Where A_b=Absorbance of the blank

A_s=The absorbance of sample

The decrease in absorbance was monitored at 517nm and Vitamin C was used as the antioxidant. The free-radical scavenging activity was evaluated by accessing its discoloration of

2,2-diphenyl1 picrylHydrozylradical (DPPH) in methanol by a Slightly modified method of Brand Williams *et al.,* (1995

3.0: RESULTS AND DISCUSSION

The result for the proximate composition of Beetroot (*Beta vulgaris*) peel is presented in Table 1 below:

Table 1: Proximate composition (%) of beetroot peel

Parameters	Values (%)
Moisture content	30.88
Ash content	10.58
Crude lipid	3.29
Crude fibre	6.98
Crude protein	4.10
Carbohydrate	44.17

The result shows that Beetroot peel has moisture content 30.88%, ash content 10.58%, crude lipid 3.29%, crude fibre 6.98%, crude protein 4.10% and carbohydrate 44.17%

Furthermore. mineral content result for Beetroot (*Beta vulgaris*) peel is presented in Table 2 below:

Table 2: Mineral content (mg/100g) of Beetroot peel

Parameter	Sample concentration
Na	4.18
Fe	26.47
Ca	BDL
Cu	0.21
Mg	5.92
Zn	BDL
K	13.82
P	11.57

BDL: Below Detectable Limit

The result showed that beetroot peel has mineral composition of Na (4.175), Fe (26.468), Cu (0.211), Mg (5.916), K (13.82)2 and P (11.57) measured in (mg/100g) with Ca and Zn having concentration that cannot be detected.

The antioxidant content of Beetroot (*Beta vulgaris*) peel is presented in Table 3:

Table 3: Antioxidant Content of *Beta vulgaris*

Parameters	Sample concentration
%inhibition	BDL

BDL: Below Dictation Limit

From the results of the analysis, beet root peel contained moisture content (30.88%) which is lower when compared to that (96.65%) obtained by Raziya *et al*., (2017) when the proximate and mineral analysis of beetroot and janum juice was carried out, this is probably because the beetroot peels were dried at room temperature. This reduced its water content. Moisture content of a dried sample means its shelf life; samples with high moisture deteriorate on storage.

Ash content signifies the level of minerals present in a sample. It is generally recognized as a measure of quality for the assessment of the functional properties of foods. The result of the analysis showed that ash content of beetroot peel was (10.58%), which falls within the range (0.95-89%) obtained by Murlidhar *et al.,* (2016) when the nutritional assessment of beetroot powder cookies was ascertained. This indicates that the sample could be a source of mineral, having nutritional importance. Fibre has useful role in providing roughages that aids digestion. The crude fibre of beetroot peel obtained was (6.98%), which is lower than that obtained from cinnamon fruit (33%) as reported by Shimala 2009. Dietary fibre helps to lower the risks of cardiovascular diseases. Crude fat content (3.29%) of beetroot peels falls within the range (0.4-13.10%) obtained by Gav *et al.,* (2019), they carried out analysis on the proximate and mineral analysis of watermelon. The low content of this byproduct can be recommended as part of weight reducing diets.

The crude protein content obtained from the analysis is (4.10%) which compared favorably with the result (3.20-19.20%) obtained by Gav *et al* (2019) from analyses on watermelon but its higher than that (1.68%) obtained by Yashwant (2009) when beetroot fruit was investigated. Crude protein present in a sample indicates that the product could support growth and movement, body defense in both livestock and humans. Carbohydrate supplies energy to cells of the brain, muscles and blood. It contributes to fat metabolism and spare proteins as an energy source and acts as mild natural laxative for humans. The high

carbohydrate content of beetroot peel (44.17%) is an indication that this byproduct could serve as a good source of energy for both animals and human beings. This value is higher than the value (17.59%) obtained from wet beetroot by Kale *et al.*, (2018).

Minerals are important component of diet because of their physiological and metabolic functions in the body. From the result, it shows that beetroot peel has magnesium 5.91 mg/100g, iron 26.46 mg/100g, sodium 4.17mg/100g, potassium 13.82mg/100g, phosphorus 11.57mg/100g, cupper 0.21mg/100mg while zinc and calcium were below the detectable limit. This shows that minerals are present in the peels analyzed which plays a vital role in the body. Bathiya *et al.*, (2019) evaluated the proximate and mineral composition of Roselle calyces waste and found out that the waste contains mineral elements. Khattack and Rahman (2016) analyzed the vegetable peels as a natural source of vitamins and minerals, their studies revealed that the peels have minerals present in them.

Antioxidant is used in the scavenging of free radicals and consequently in the prevention of diseases like cancer, cardiovascular diseases. The sample (beetroot) has no antioxidant property as it was not detected.

4.0: CONCLUSION AND RECOMMENDATIONS

4.1: Conclusion

The results of the analysis showed that the peel regarded as waste can be consumed by both animals and human, as it has an appreciable amount of proximate composition. Also, the elemental analysis showed that the peel has relatively high level of iron, potassium, phosphorus, magnesium, sodium and copper while calcium and zinc were not detected, these minerals are needed for digestibility, electrolyte balance, neurotransmission, development of strong bones and teeth.

Therefore, it can be concluded that the peel should also be consumed just as the pulp since it has the required compositions suitable for the body system.

4.2: Recommendation

Following the findings of this research, the followings are recommended:

Individuals should be enlightened on the consumption of beetroot peel as it also has parameters and elements that are beneficial to humans. The peels should be incorporated in animal feeds as it's nutritious. Further study should be carried out to exploit the other nutrients which might be present in the peel. A study should also be carried out to ascertain why there is no antioxidant activity in peel unlike the pulp.

5.0: ACKNOWLEDGEMENT

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