## Original Research Article

## NUTRIENTS COMPOSITION OF SOME RED VEGETABLES FROM FRUIT GARDEN MARKET IN PORT HARCOURT

**ABSTRACT**

Vegetables are fresh parts of plants whicheither raw, cooked, canned or processed in any other form, provide suitable human nutrition. This study was aimed at evaluating the nutrient composition of some red vegetables. Radish, Rhubarb, Strawberry, Beetroot and Red cabbagesamples were purchased from fruit garden market, Port Harcourt, washed, oven dried at 500C and ground into powder using a manual grinder and preserved for proximate composition, vitamin and mineral analysis. The analysis was conducted using standard methods.The result of proximate analysis showed that the percentage (%) composition of ash (4.58±0.07), protein (2.79±0.13) and fat (6.81±0.10) were significantly higher in strawberry when compared to other vegetables. Radish had the highest fibre (3.39±0.06) and moisture content(83.88±0.06) while the highest value of carbohydrate (29.50±0.04) was recorded in rhubarb. The result for vitamin analysis (mg/kg) showedthat the vitamin A and C content were significantly higher in strawberry when compared to others. Also, it was observed that vitamin B1showed no significant difference in all the samples. The result for mineral analysis (mg/kg) showed that manganese and iron content were significantly higher in strawberry (0.55±0.02 and 1.39±0.03) when compared with othersamples. Copper had the highest value in beetroot while the highest concentration of zinc was recorded in radish. The value of nickel (0.01±0.00) showed no significant difference in all the samples. The results suggest that the vegetables analysed contain appreciable amounts of nutrients including vitamins and minerals, thus should be included in diets to supplement daily dietary allowances needed by the body, hence improving nutritional status and curbing the problem of micronutrient deficiency.

**KEY WORDS: Vegetable, proximate, vitamin, mineral, nutritional status**

**INTRODUCTION**

Vegetables are horticultural cropsthat can be consumedin raw, cooked, canned or processedforms(Quebedeaux and Eisa, 2019). They are important components of diet as they are rich sources of phytonutrients:vitamins (A, B1, B6, B9, C, E and K), minerals, dietary fiber, phytochemicals (flavonoids, phenolic, bioactive peptide). Some phytochemicals of vegetables are strong antioxidants and they help in reducing the risk of chronic disease by protecting the body against free-radical damage. They modify metabolic activation and detoxification of carcinogens, or even influencing processes that alter the course of tumor cells (Quebedeaux and Eisa, 2019). Vegetables in the daily diet have been strongly associated with overall good health, improvement of gastrointestinal health and vision, reduced risk for some forms of cancer, heart disease, stroke, diabetes, anaemia, gastric ulcer, rheumatoid arthritis, and other chronic diseases (Wargovich, 2020). Diet with high vegetable content has been associated with lower risk of cardiovascular disease in humans while a low vegetable intake, in unbalanced diets, has been estimated to cause about 31% of ischaemic heart disease and 11% of stroke worldwide. According to the 2007 World Health Report unbalanced diets with low vegetable intake and low consumption of dietary fiber are estimated to cause some 2.7 million deaths each year, and were among the top 10 risk factors contributing to mortality (Dias and Ryder, 2021). Red vegetables provide cardioprotective roles and reduce the risk of developing atherosclerosis, hypertension and high cholesterol since they contain antioxidants (Magda *et al.,* 2021). They can improve brain function and reduce the risk of acquiring cancers including prostate cancer. The red coloration of these vegetables can be attributed to their phytonutrients such as anthocyanins, betacyanin, betalain, and carotenoids such as lycopene (Magda *et al.,* 2021). Sine commonred vegetables are red cabbage, raddish, rhubarb, beetroot and strawberry.

*Brassica oleracea*var. commonly known as red cabbageis a cool season leafy vegetable belonging to the group of colecrops (Brassicaceae family). It is widely used for various purposes as salads, cole slaw, sauerkraut, soup, curries and other cooking purposes. Red cabbage is known for possessing different chemical compounds and medicinal properties (Chaudhary*et al.,* 2010). The popularity of red cabbage is for its rich content of phytochemicals, antioxidants, vitamins(C,E,A,K) and minerals (calcium, manganese, magnesium, iron, and potassium), and low content of saturated fatsand cholesterol (Fan *et al.,* 2016).

*Raphanussativus*L commonly known as raddish originates from Europe and Asia. It grows in temperate climates at altitudes between 190 and 1240 m. It is 30–90 cm high and its roots are thick and of various sizes, forms, and colors. They are edible with a pungent taste (Magda *et al.,* 2021). It is a root vegetable grown and consumed globally and is considered part of the human diet, even though it is not common among some populations. Usually, people eat radishes raw as a crunchy vegetable, mainly in salad, while it also appears in many European dishes. Some people, at least in the Middle East, prefer to drink its juice due to its health beneﬁts (Magda *et al.,* 2021).

Rheum rhabarbarum commonly known as rhubarb is a hardy, herbaceous edible [perennial](https://www.britannica.com/science/perennial) of the smartweed family (Polygonaceae) native to Asia and grown for its large [edible](https://www.britannica.com/dictionary/edible) petioles (leafstalks). It is commonly grown in cool areas of the temperate zones. The leaves contain some antinutrients such as [oxalic acid](https://www.britannica.com/science/oxalic-acid), and are not eaten (Tanhuanpaa*et al.,* 2019).

Red beetroot (*Beta vulgaris*) is a traditional and popular vegetable in many parts of the world. It is the red root vegetable that is most typically associated with the word “beet”. Today, beetroot is regularly consumed as part of the normal diet, either fresh or after thermal processing or fermentation, and commonly used in manufacturing processes as a food colouring agent (Liliana and Oana-Viorela, 2020).

Strawberry (*Fragaria x ananassa*) is one of the most consumed fruits in the world and it is the second most produced fruit. Besides being an attractive fruit due to its color and flavor, strawberries are largely consumed both as fresh fruit or processed, and it promotes health by having antioxidants compounds, including anthocyanins, flavonoids, phenolic compounds and nutrients (Manganaris*et al.,* 2014).

Red vegetables are highly consumed, not only because of their economic importance, but also due to their nutritional and medicinal values. This research work reviews the nutritive content of some selected red vegetables.

**MATERIALS AND METHOD**

**Sample Collection and Preparation**

Vegetable samples were purchased from fruit garden market, Port Harcourt and kept in a cool dry place. The samples were identified by Dr. M.G. Ajuru of Plant Science and Biotechnology Department, Rivers State University, OroworukwoNkpolu Port-Harcourt and the registration numbers are RSUpb0124 for *Fragaria x ananassa*,RSUpb0125 for *Beta vulgaris*,RSUpb0126 for*Brassica oleracea* var, RSUpb0127 for Rheum rhabarbarum and RSUpb0128for*Raphanus sativus* L .

The samples were properly washed, oven dried at 500C and ground into powder using a manual grinder and preserved for proximate composition, vitamin and mineral analysis.

**Proximate Analysis:** The [AOAC, 1990] methods were adopted for the determinationof moisture content, ash content, crude fibre and crude protein. Crude fat was carried out by Soxhlet fat extraction method while carbohydrate was determined using differential method (100 – [%Protein + %Moisture + %Ash + %Fat + %Fibre]).

Bayfield & Cole (1980) method was adopted for the Analysisof vitamin A. Vitamin E was estimated in the sample by the Emmerie-Engel reaction as reported by Rosenberg (1992). The method of Roe .& Kuether (1943) was used for the spectrophotometric analysis of vitamin C. Vitamin D was assayed according to the method of liquid chromatography (LC) with UV absorbance detection. Vitamins B1, B2, and B12 were analysed by spectrophotometric method, while B3 and 6 were analysed by titrimetric method.

**Analysis of minerals:** Heavy metal analysis was conducted to determine the mineral composition of the sample using Agilent FS240AA Atomic Absorption Spectrophometer.

**Statistical Analysis:** All data were presented as mean standard deviation. Data were analysed with one-way analysis of variance (ANOVA) using the SPSS version 20.0. Results were compared among groups with the Scheffe’s post hoc test and considered significant a confidence level (p<0.05).

**RESULT AND DISCUSSION**

Table 1: Proximate Composition of Some Vegetables

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Samples | Beetroot | Red cabbage | Strawberry | Radish | Rhubarb |
| Ash | 2.36±0.14bdeh | 1.78±0.06\*adfh | 4.58±0.07\*bcfh | 2.17±0.02bdeh | 2.68±0.08\*bdfg |
| Fibre | 0.99±0.01bdfh | 0.69±0.01\*adfh | 0.87±0.02\*bcfh | 3.39±0.06\*bdeh | 0.46±0.01\*bdfg |
| Protein | 0.76±0.09adeh | 0.91±0.02adfh | 2.79±0.13\*bcfh | 0.65±0.08bdeh | 1.22±0.03\*bdfg |
| Fat | 5.0±0.01bdeh | 4.46±0.08\*adfh | 6.81±0.10\*bcfh | 4.86±0.08bdeh | 5.40±0.01\*bdfg |
| Carbohydrate | 14.17±0.08bdfh | 17.50±0.08\*acfh | 17.50±0.03\*acfh | 5.31±0.08\*bdeh | 29.50±0.04\*bdfg |
| Moisture | 76.97±0.05bdfh | 74.78±0.13\*adfh | 67.63±0.12\*bcfh | 83.88±0.06\*bdeh | 60.94±0.11\*bdfg |

Values are express as mean ± standard deviation

The mean difference is significant at the 0.05 level when comparing Beetroot with others.Values with different superscript(a,b) show significant difference when comparing Red cabbage with others.Values with different superscript (c,d) show significant difference when comparing Strawberry with others.Values with different superscript (e,f) show significant difference when comparing Radish with others.

**Table 2-Vitamin Content of Some Vegetables**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Samples | Beetroot | Red cabbage | Strawberry | Radish | Rhubarb |
| Vitamin A | 5.61±0.16bdfg | 3.75±0.12\*adfh | 12.10±0.03\*bcfh | 5.19±0.06\*bdeh | 5.83±0.08bdfg |
| Vitamin B1 | 0.02±0.00 | 0.02±0.00 | 0.01±0.00 | 0.01±0.00 | 0.01±0.00 |
| Vitamin B2 | 0.13±0.03acfg | 0.15±0.01adfg | 0.09±0.01bcfg | 0.03±0.01\*bdeh | 0.12±0.01acfg |
| Vitamin B3 | 0.62±0.02bdeg | 0.51±0.01\*acfg | 0.51±0.03acfg | 0.68±0.03bdeh | 0.54±0.05acfg |
| Vitamin B6 | 0.24±0.01bcfh | 0.19±0.00\*adeh | 0.22±0.01bcfh | 0.19±0.01\*adeh | 0.27±0.01\*bdfg |
| VitaminB12 | 3.42±0.07bdfh | 2.81±0.04\*adfh | 3.94±0.08\*bcfh | 4.62±0.08\*bdeh | 4.15±0.01\*bdfg |
| Vitamin C | 71.14±0.06bdfh | 59.15±0.08\*adfh | 108.26±0.08\*bcfh | 72.47±0.06\*bdeh | 71.19±0.03\*bdfg |
| Vitamin D | 22.26±0.08bdfh | 20.98±0.04\*adfh | 18.45±0.08\*bcfh | 7.56±0.08\*bdeh | 10.96±0.05\*bdfg |
| Vitamin E | 5.94±0.08bdfh | 8.12±0.09\*adfh | 7.14±0.09\*bcfh | 7.77±0.08\*bdeh | 8.88±0.13\*bdfg |

Values are express as mean ± standard deviation

The mean difference is significant at the 0.05 level when compairing Beetroot with other.Values with different superscript(a,b) show significant difference when comparing Red cabbage with others.Values with different superscript(c,d) show significant difference when comparing Strawberry with others.Values with different superscript(e,f) show significant difference when comparing Radish with others

**Table 3-Mineral Content of Some Vegetables**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Samples | Beetroot | Red cabbage | Strawberry | Radish | Rhubarb | WHO/FAO permissible limit (mg/kg) |
| Mn | 0.35±0.04bdfh | 0.49±0.03\*aceg | 0.55±0.02\*acfg | 0.45±0.02\*adeg | 0.50±0.03\*aceg | N/A |
| Fe | 1.21±0.04bdfh | 1.00±0.01\*adfg | 1.39±0.03\*bcfh | 1.23±0.03bdeh | 1.04±0.04\*adfg | 425.5 |
| Cu | 0.49±0.03bdfh | 0.19±0.01\*acfg | 0.22±0.01\*acfh | 0.34±0.04\*bdeh | 0.13±0.02\*adfg | 73.3 |
| Zn | 0.40±0.01bcfg | 0.29±0.01\*adfh | 0.41±0.02bcfg | 0.54±0.04\*bdeh | 0.39±0.02bcfg | 99.4 |
| Co | 0.02±0.00 | 0.01±0.00 | 0.01±0.00 | 0.01±0.00 | 0.01±0.00 | N/A |
| Pb | 0.02±0.00 | 0.05±0.01 | 0.04±0.00 | 0.03±0.00 | 0.04±0.01 | 0.3 |
| Cd | 0.01±0.00ch | 0.02±0.00cg | 0.01±0.00ch | 0.02±0.00cg | 0.03±0.00dg | 0.2 |
| Cr | 0.01±0.00acfg | 0.01±0.00acfg | 0.01±0.00\*acfg | 0.00±0.00bdeh | 0.01±0.00acfg | N/A |
| Ni | 0.01±0.00 | 0.01±0.00 | 0.01±0.00 | 0.01±0.00 | 0.01±0.00 | 67.9 |
| Se | 0.03±0.01bdfg | 0.07±0.01\*acfh | 0.06±0.01\*aceh | 0.05±0.00\*bceg | 0.04±0.00bceg | N/A |

N/A = Not available

Values are express as mean ± standard deviation

The mean difference is significant at the 0.05 level when comparing Beetroot with other.Values with different superscript(a,b) show significant difference when comparing Red cabbage with others.Values with different superscript(c,d) show significant difference when comparing Strawberry with others.Values with different superscript(e,f) show significant difference when comparing Radish with others.

**Discussion**

Vitamins are micronutrients needed for normal functioning and development of the body. Vitamins can be classified intofat-soluble (A,D,E and K) and water-soluble vitamins (B complexes and C). Table 1 showedthe proximate composition of selected red vegetables. The results showedthat the ash, protein and fat content were significantly higher in strawberry when compared with other red vegetables. The result also showed that the fibre and moisture contents were significantly higher in Radish when compared with others. The carbohydrate content of the selected red vegetables was significantly higher in Rhubarb when compared with other red vegetables.

Ash content of a food substance is the quantity of inorganic non-combustible material contained in the food. It is often used as measure of the mineral composition of various food substances (Akinwunmi and Omotayo, 2016). The (%)ash content of the selected vegetables ranged from (1.78±0.06) to (4.58±0.07). The Ash content in strawberry was significantly higher when compared to other vegetables. The high ash content of strawberry indicates that it is rich in organic matter which is convertible to oxides and water upon heating (Akinwunmi and Omotayo, 2016).

Crude fibre is a dietary component found in plant-based foods and it is essential for dietary health. The crude fibre content of the samples ranged from 0.69±0.01 to 3.39±0.06. Radish significantly had increased crude fibre content when compared to other vegetable samples. Since radish contained significant amounts of crude fibre, it could be regarded as good sources of dietary fibre for supplementation of foodstuffs with less fibre, hence utilized as roughage. Dietary fibre helps to prevent constipation, bowel problems and piles (Ashaolu and Omotayo, 2007). Similar result was observed in the findings of Aslam *et al* (2019) who investigated the crude fibre content of vegetables cultivated in Bangladesh and reported that radish had the highest ash content compared to other vegetables.

Proteins are macronutrients needed for growth and maintenance of the body. They play vital roles in the formation of blood cells, protection, growth and maintenance of tissue, skin, hair, muscle, connectile tissue, bone marrow and vital organs (Akinwunmi and Omotayo, 2016). The protein content of the vegetables was significantly higherin strawberry. The protein content of the vegetables in this study ranged from (0.65±0.08) to (2.79±0.13) and the values obtained in these species of vegetables are lower than that of Akinwunmi and Omotayo, (2016)who reported that the protein content of vegetables ranged from (3.69±0.10) to (6.21±0.12). The result shows that the vegetables studied are good sources of protein.

Fat or plant lipids are substances that can be stored as energy reserves or have structural functions such asin cellular membranes (Ashaolu and Omotayo, 2007). The fat content of vegetables in this study were significantly high. In the findings of Joselu*et al.,* (2019), it was revealed that high water content found in vegetables dilute fat, thus reducing the fat content of vegetables. The low-fat content found in red cabbage could be attributed to its high moisture content.

Carbohydrates are rich source of energy for nutrition and they are readily fermented by microbes to yield carbon-dioxide, alcohol, organic acids and other compounds (Fagbohun*et al.,* 2011). The carbohydrate content of the selected vegetables was significantly high with rhubarb having the highest composition. This result shows that the selected vegetables are good sources of carbohydrate because of their high composition of it. Fagbohum*et al.,* (2011) reported that vegetables are excellent sources of dietary fibre which is a type of carbohydrate. Thus, the high carbohydrate content of rhubarb could be due to its high fibre content as observed in this study.

Moisture is the water content of a substance and this significantly contributes to the texture of leaves of vegetables and help in maintaining cellular compartments. The moisture content of the selected vegetables was significantly higher than other parameters analyzed and the highest moisture content was found in radish.High moisture content of vegetables makes them to aid the digestion of food, however high moisture content also reduces the shelf-life of vegetables because they facilitate microbial growth and actions resulting into spoilage (Fagbohun*et al.,* 2011).

Vitamins are micronutrients needed for metabolism, protection, maintenance of health and proper growth. They cannot be synthesized by the body, thus obtained from external sources like diet, rumen of bacteria and sun. Vitamins assist in the formation of hormones, blood vessels, nervous system chemicals and genetic materials. They generally act as catalysts, combining with proteins to create metabolically active enzymes that are essential for life reactions (Peter, 2013).

Table 2 showed the vitamin content of selected vegetables.The result for vitamins showed that the vitamin A and C content were significantly higher in strawberry when compared with other red vegetables.From the result it was observed that vitamin B1 showed no significant difference in all the samples. Vitamin B2 content was significantly high in red cabbage when compared with other red vegetables. Vitamin B3 and B12 content were significantly higher in Radish when compared with others. Vitamin B6 content was significantly high in Rhubarb when compared with other red vegetables. Vitamin D content was significantly high in Beetroot when compared to otherswhile vitamin E content was significantly high in Rhubarb when compared with other red vegetables.

Vitamin A is a fat-soluble vitamin and an essential nutrient for humans. It is important to the body for playing an effective role in growth and development, the visual system, immunity, and reproduction as well as supplying epithelial cellular integrity (Peter, 2013). The result obtained in this study shows that the highest value of vitamin was recorded in strawberry and the least value was seen in red cabbage. The substantial amount of vitamin A recorded in strawberry shows that it can help in vision and immune functions.

Vitamin C is a water-soluble vitamin, one that is not able to be in storage by the body except in insignificant amounts. Vitamin C is a powerful antioxidant that protects your cells from damage by free radicals produced by cigarette smoke, air pollution, excessive sunlight, and normal metabolism. The substantial amount of vitamin C in strawberry also shows that it can help in normal formation of intercellular substances throughout the body, including collagen, bone matrix and tooth dentine. Deficiency of vitamin C causes fragility to blood capillaries, gum decay and scurvy (Bender, 2009).

Vitamin B1showed no significant difference in the vegetable samples. Beetroot had the highest value of vitamin D and the least value of vitamin E while radish had the highest value of vitamin B12 and B3. High values of vitamin B2 were recorded in red cabbage, beetroot and rhubarb while high values of vitamin B6 were recorded in rhubarb, beetroot and strawberry. Some of these vitamins are beneficial in growth, digestion and stimulation of appetite while vitamin E acts as antioxidant. The results on the composition of these vitamins could be helpful to create nutritional awareness among people on the importance of these green vegetables and thus increase the consumption of these vegetables.

Table3 showed the mineral content of selected vegetables. The result showed that manganese and Iron content were significantly higher in strawberry when compared to others; from the result copper content was significantly high in Beetroot than in others.

Zinc content was significantly higher in Radish when compared with other vegetables. From the result, it was observed that the values of cobalt, lead and nickel in the vegetables showed no significant difference at (p <0.05) level when compared with other red vegetables.The result also showed that the values of cadmium, chromium and selenium in the vegetables showed no significant difference at (p<0.05) level.

There are many minerals that are essential for a normal healthy body. Vegetables have a good mix of minerals, and their fruiting bodies are characterized by high levels of assailable mineral constituents. From the table, it was observed that minerals such as manganese, iron, copper and zinc were higher in concentration in the selected vegetables than others. It also shows that manganese and iron had their highest values in strawberry, copper had the highest value in beetroot while the highest concentration of zinc was recorded in radish. The value of nickel was the same in all the vegetable samples. The results showed that the vegetables studied are good sources of mineral elements

Copper is known to be an important micronutrient that is important for several metabolic and biochemical processes such as bone development, hemoglobin synthesis and connective tissue metabolism. Cu helps the body to get rid of free radicals, make red blood cells, protect the nerve cells and prevent cell structure damage. Copper deficiencies are not common, as the human body constantly supplies copper and needs very minute copper in order to perform efficiently. Conditions relating to Cu deficiency include anemia, osteoporosis, mental retardation etc. The concentration of chromium in the samples ranged from 0.13±0.02 to 0.49±0.03 which indicates safety since it is below permissible limit (73.3mg/kg).

Iron is an essential mineral for life including diets and it also plays an important role in the production of hemoglobin, oxygen and electron transfer in human body. Iron Deficiency could result to anemia, irritability, eye defect, hair loss, chronic bleeding and severe fatigue. Long term exposure to higher concentrations of Fe could lead to vomiting, diarrhea, conjunctivitis and hepatic failure. Iron was found to have a lesser concentration in the spice samples analyzed when compared with the limit provided by the organization. The concentration gotten ranged from 1.00±0.01 to 1.39±0.03 proving to be safe for consumption (Mensah *et al.,* 2009).

On normal concentration, Chromium is seen to be an important trace element needed for biosynthesis of glucose tolerance factor and its biological useful form (Cr3+) has the potential to initiate insulin action. Conversely, Cr (IV) is more toxic. Exposure to Cr can occur through food, it is considered an essential metal for several metabolic processes which include carbohydrate and lipid metabolism. Higher concentration of Cr in the human body could be detrimental leading to skin cancer and dermatitis, defect of the kidney, stomach and respiratory tract system (Olayemi*et al*., 2019). The concentration of chromium in the samples ranged from 0.00±0.00 to 0.01±0.00 which indicates safety since it is below permissible limit (73.3mg/kg).

Manganese is a nutritional element essential for different biochemical processes. Mn is required for bone development, wound healing, reproduction and proper functioning of the central nervous system. Its excess in the body causes gait, apathy and tremors while its deficiency leads to bleeding disorder (Prashnath*et al.,* 2015), reproductive failure in both male and female and also causes impaired growth (Saraf and Samant 2013).

Lead (Pb) forms complexes with oxo-groups in enzymes used in hemoglobin synthesis and porphyrin metabolism (Ademoroti, 2009). Lead is a toxic metal of public health concern with no known biological function and has been reported to induce toxicity at concentrations as low as 10μg/kg (WHO/FAO 2009). Generally, Pb is non-essential metal as such its presence in the samples suggests toxicity. The result of this study shows that the concentration of lead found in the vegetables were very low and below permissible limit. Although, the concentrations of in all the vegetable samples studied were very low, care needs to be taken in the consumption of Pb-contaminated vegetables since Pb exposure is through direct contact.

Like Lead, Cadmium is a non-essential metal and highly toxic. It does not play any role in biological diversity in living organisms and could lead to death of cells or increase it proliferation (Iwegbue*et al.,* 2015). Even at low concentration, Cd could be detrimental to living organisms (Ambedkar and Muniyan, 2012). Cd poisoning in man could cause anemia, renal damage, bone disorder and cancer of the lungs (Edward *et al.,* 2013). The levels of cadmium obtained in this study were below permissible limit.

**Conclusion**

The results obtained from the proximate analysis of the vegetable samples showed that they are good sources of nutrients such as protein, dietary fibre, vitamins and therefore can be ranked as highly nutritious. Therefore, it can be concluded that these vegetable species are good source of nutrients and if consumed in sufficient amount, it would contribute greatly to the human nutritional requirement for normal growth and adequate protection against diseases arising from malnutrition. The studies also showed that vegetables are good sources of macro and micro mineral elements. However, attention should be given to the vegetable samples analysed as they contained lead and cadmium which could be harmful to human after prolong exposure to these metals even at low concentration.

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