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Nutrient Composition and Heavy Metals Content of Three Leafy Vegetables (*Amaranthus Cruentus* L., *Lactuca Sativa* L., *Solanum Macrocarpon* L.) in Porto-Novo, Republic of Benin

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Abstract The interest of leafy vegetables has increased in recent years, mainly because of health benefits due of their nutritional compounds. Knowledge of the nutrients of vegetables is necessary to better value them in the diet of the population. The aim of this study was to determine the nutrients of three green leafy vegetables cultivated and consumed at Porto-Novo. For this purpose, using standard methods, carbohydrates, protein, fat, crude fibre, ash, calcium, potassium, magnesium, iron and zinc were determined in 24 samples of *Amaranthus cruentus* L., *Solanum macrocarpon* L. and *Lactuca sativa* L. and were compared. Also, heavy metals (Pb, Cd) contents of these vegetables and of soils were compared. The significant difference between nutrients of leafy vegetables was tested by ANOVA. *Lactuca sativa* L. has the highest water content, *Amaranthus cruentus* L. has the highest content of proteins, ash, fibre, zinc, calcium and potassium while the *Solanum macrocarpon* L. has the highest content of fat and iron. *Solanum macrocarpon* L. has the highest lead content while *Amaranthus cruentus* L. has the highest cadmium content. These results show that leafy vegetables could provide an important part of nutritional requirements for the adequate protection against diseases. The results suggest that *Amaranthus cruentus* L. has the high content of nutrients followed by *Solanum macrocarpon* L. and *Lactuca sativa* L.. Cadmium and lead found in vegetables of this study in Porto-Novo must be monitored and managed to prevent adverse consequences on human health.

Keywords: *Amaranthus cruentus* L., *Lactuca sativa* L., *Solanum macrocarpon* L., *nutrients, bioaccumulation, cadmium (Cd), lead (Pb)*

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1. Introduction

Vegetables and fruits are sources of nutrients which help to cure certain metabolism disorders [1,2,3]. Moreover, vegetables contribute to fight food insecurity and malnutrition because they are an important component of human diet providing nutrients [4,5]. Green leafy vegetables play important nutritional and medicinal role in several continents [6,7,8,9]. Nevertheless, the worldwide vegetables consumption levels are lower than the recommended guidelines [10] and the decrease of vegetables consumption undoubtedly will increase risk of several noncommunicable diseases, such as coronary heart disease, stroke and, the risk of different types of cancers [11,12]. In Republic of Benin, the market gardening production has increased from 325,519 tonnes in 2008 to 633,862 tonnes in 2015, a growth rate of 95% [13]. In this context, knowledge of the nutritional value of vegetables is necessary. Thus, the purpose of this study was to assess nutrients and heavy metals contents in some green leafy vegetables in Porto-Novo, Republic of Benin.

2. Materials and Methods

2.1. Sampling

The study was conducted in the city of Porto-Novo, capital of the Republic of Benin in West Africa. Porto-Novo is located at 6°29’50’’ north and 2°36’18’’ east. The area of Porto-Novo is 110 km², about 1.08% of the national territory area.

Leafy vegetables including amaranth (*Amaranthus cruentus)*, large nightshade (*Solanum macrocarpon)*, and lettuce (*Lactuca sativa)* were randomly collected during March 2018. The mature leaves were taken from the stems, put in sterile packs, transported to the laboratory, washed, drained and analysed. For nutritive parameters, twenty-four (24) samples of each vegetable at production level were taken from three districts of Porto-Novo (Akonaboè, Akron and Ouando) with eight (8) samples per district. Floristic keys were used at the National Herbarium of University of Abomey-Calavi in Benin for determining each variety.

2.2. Nutrient Analysis

Moisture, protein, fat and ash were conducted according to the standard methods [14] and crude fibre was conducted according to the method described by [15]. Mineral elements (iron, zinc, potassium, calcium, magnesium) and heavy metals (cadmium, lead) were determined by using the ThermoFisher Scientific Atomic Absorption Spectrometer equipment.

2.2.1. Moisture Content

Dried empty dish is cooled in dessicator. The empty dish and lid were weighed. Weigh 3 grams of vegetable in the dish and spread the sample to the uniformity. Place the dish with the sample in the oven and dry for 3 hours at 105 °C. After drying, transfer to the desiccator to cool and weigh.

2.2.2. Protein Analysis

Protein content was made using Kjeldahl method. Place 1 gram of sample into digestion flask, add Kjeldalh catalyst tablet, add sulfuric acid and digest until the mixture is clear to get complete breakdown of all organic matter. Cool and add 60 ml of distilled water cautiously. Ammonia was steam distilled from the digest to which had been added 50 ml of NaOH 33%. About 150 ml of the distillate were collected in a conical flask containing boric acid 4% and mix indicator. Titrate with standardized HCl and the conversion factor used is 6.25.

2.2.3. Fat Analysis

Pre-dry the sample at low temperature to make it easier to grind and better extraction. Weigh 5 g of sample in filter paper and wrap. Take the sample into extraction thimble and transfer into soxhlet. Fill the pre-dried bottle with 250 ml of petroleum ether and take it on the heater apparatus. Connect the soxhlet apparatus, turn on the water and switch on the heater. Extract at least for 4 h. Evaporate the solvent by using the vacuum condenser. Dry until solvent is completely evaporated, cool in dessicator and weigh.

2.2.4. Crude Fibre

Weigh 2 g of dried and finely ground sample. Powdered dried sample was placed in a 500 ml beaker, and 200 ml of boiling H_2SO_4 1.25% was added. The beaker was placed on a hot plate and boiled for 5 min with occasional rotation of the beaker. The beaker was cooled and filtered through a Buchner funnel. The beaker was rinsed with two portions of 50 ml of boiling water. The residue was carefully transferred into a beaker, and 200 ml of NaOH 1.25% was added. It was boiled for 30 min, cooled and filtered, and washed twice with 50 ml of boiling water. The sample was washed twice with 25 ml of alcohol 95%. The residue was oven dried for 3 hr at 130^0C and cooled in a desiccator and weighed. The sample was heated for 60 min at 550^0C and cooled in a desiccator and weighed. Repeat until constant weigh.

2.2.5. Ash Analysis

Weigh 5 g of sample in the tared, pre-heated crucible. Heat over low Bunsen flame until fumes are no longer produced. Place in muffle furnace, heat at 550 °C overnight and until the ash turns to grey.

2.2.6. Carbohydrates

Carbohydrates were determined according to the method of Greenfield and Southgate [16] by subtracting the sum of the percent of protein, moisture, fat, crude fibre and ash from 100%.

2.2.7. Minerals

Leafy vegetables samples are spread on clean paper and then placed in the oven at a temperature of 80 °C until complete desiccation. Samples were then crushed and ground into a mortar. Ten (10) ml of hydrogen peroxide (H_2O_2) were added to one gram (1g) of sample and left for 24 hours. One (1) ml of nitric acid (HNO_3, 65%) and 3 ml of hydrochloric acid were added. The solution is mineralized at 150°C for 2 hours. Five (5) ml of distilled water were added and heated for 10 minutes. The solution obtained is made up to 50 ml and filtered. The filtered solution is used to assay minerals on Atomic Absorption Spectrophotometer.

Soil samples were directly spread on clean paper before being placed in the oven at a temperature of 80 °C until completely desiccated. Soil samples were sieved to collect fraction less than 63 µm in diameter. One (1) ml of nitric acid (HNO_3, 65%) and 3 ml of hydrochloric acid were added. The solution is mineralized at 150 °C for 2 hours. Five (5) ml of distilled water were added and heated for 10 minutes. The solution obtained is made up to 50 ml and filtered. The filtered solution is used to determine the minerals on the Atomic Absorption Spectrophotometer.

2.3. Statistical Analysis

The data have been presented with mean±standard deviation and the statistical significance of difference between nutrients of leafy vegetables tested by ANOVA using SPSS software. The criterion for significance was set at $p<0.05$.

Transfer factor of heavy metal from soil to leaves of vegetables was calculated using the following equation:

$$\text{Transfer factor} = \frac{\text{Heavy metal concentration in leaves of vegetable}}{\text{Heavy metal concentration in soil}}$$

Pearson bivariate correlation was used to see the correlation of heavy metals contents between vegetables and soil.

3. Results and Discussion

3.1. Macronutrients of Leafy Vegetables

A diversity of vegetables is observed in market gardening sites in Porto-Novo and green leafy vegetables cited in Table 1 are among the most cultivated [17]. Figure 1, Figure 2 and Figure 3 show respectively *Solanum macrocarpon* L., *Amaranthus cruentus* L. and *Lactuca sativa* L. in fields at Porto-Novo (Benin).

Figure 1. Solanum macrocarpon

Figure 2. Amaranthus cruentus

Figure 3. Lactuca sativa

Table 1. Details of Green Leafy

N° Identification	Common name	Green leafy vegetables	Family	Local name (Fongbé)
YH 255/HNB	Amaranth	Amaranthus cruentus L.	Amaranthaceae	Fotêtê
YH 255/HNB	Lettuce	Lactuca sativa L.	Asteraceae	Salada
YH 255/HNB	Large nightshade	Solanum macrocarpon L.	Solanaceae	Gboma

Table 2. Macronutrients Composition of Leafy Vegetables (% fresh weight)

	Nutrients	Ouando (N=8)	Akon (N=8)	Akonaboè (N=8)	Porto-Novo (N=24)
Amaranth	Water	84.54±1.22^{a}	84.90±1.87^{a}	84.68±1.24^{a}	84.64±1.42
	Proteins	5.19±0.80^{a}	4.17±1.13^{b}	5.29±0.61^{a}	4.88±0.98
	Fat	0.28±0.83^{a}	0.28±0.09^{a}	0.31±0.08^{a}	0.29±0.08
	Ash	2.27±0.08^{a}	1.81±0.30^{b}	2.28±0.26^{a}	2.12±0.32
	Fiber	1.55±0.28^{a}	1.48±0.37^{a}	1.60±0.34^{a}	1.54±0.32
	Carbohydrates	6.17±1.17^{a}	7.37±1.22^{a}	6.03±1.04^{a}	6.52±1.25
Lettuce	Water	88.22±1.16^{a}	89.25±1.49^{a}	89.12±1.43^{a}	88.86±1.39
	Proteins	1.35±0.33^{a}	1.87±0.18^{b}	1.65±0.48^{b}	1.62±0.40
	Fat	0.25±0.09^{a}	0.29±0.14^{a}	0.31±0.12^{a}	0.28±0.11
	Ash	1.51±0.31^{a}	1.27±0.11^{a}	1.52±0.21^{a}	1.44±0.24
	Fiber	1.06±0.09^{a}	1.02±0.14^{a}	1.17±0.11^{a}	1.08±0.12
	Carbohydrates	7.61±1.27^{a}	6.30±1.32^{a}	6.24±1.06^{a}	6.71±1.33
Nightshade	Water	87.52±1.21^{a}	86.66±1.21^{a}	87.18±0.69^{a}	87.12±1.08
	Proteins	2.66±0.45^{a}	3.58±0.57^{b}	3.33±0.41^{b}	3.19±0.60
	Fat	0.46±0.10^{a}	0.72±0.23^{b}	0.48±0.08^{a}	0.55±0.19
	Ash	1.83±0.32^{a}	1.95±0.19^{a}	1.73±0.27^{a}	1.86±0.27
	Fiber	1.26±0.15^{a}	1.19±0.08^{a}	1.22±0.15^{a}	1.22±0.13
	Carbohydrates	6.28±1.47^{a}	5.90±1.39^{a}	6.06±0.77^{a}	6.08±1.21

Values on a same line followed by the same letter are not significantly different at $p < 0.05$.

The nutritional contents of amaranths, lettuces and nightshades leaves varied (Table 2). Moisture ranged from 84.64±1.42% (amaranth) to 88.87±1.39% (lettuce) ($p>0.05$). Moisture showed no difference in the same type of vegetable in the three districts ($p>0.05$). These values fall within the range of 70 to 90% reported by some authors [18,19,20] in vegetables. High-water content may induce a greater activity of soluble active substances like enzymes which make the vegetable perishable leading to postharvest losses.

Protein contents varied from 1.62±0.40% in lettuces to 4.88±0.98% in amaranths. Protein of amaranths at Akron (4.17±1.13%) was observed to be lower than those of Ouando (5.19±0.80%) and Akonaboè (5.29±0.61%), while proteins of lettuces (1.87±0.18%, 1.65±0.48%) and nightshades (3.58±0.57%, 3.33±0.41%) at Akron and Akonaboè were higher than those of Ouando ($p>0.05$). These values of protein are in agreement with the results found by some authors in vegetables in South Africa [21,22] and in Italy [23]. Even if these plants are poor source of protein, plant proteins have protecting properties [24] and it is reported that plant protein content may be influenced by cultivar and environment [25].

Fat content of nightshades (0.55±0.19%) is higher than those of amaranths (0.29±0.08%) and lettuces (0.28±0.11%). In accordance with the Table 2, no difference of fat was observed in the same type of leafy vegetable in the three districts ($p>0.05$), except fat in nightshades at Akron ($p<0.05$). These values show that leafy vegetables are poor source of fat. Reference [22] reported fat of leafy vegetables from 0.2% to 2.7% in South Africa. Thus, leafy vegetables are good for obese people, as excess fat can trigger cardiovascular disorders [26].

The ash contents varied from 1.44±0.24% (lettuces) to 2.12±0.32% (amaranths). There was no difference of ash between lettuces and nightshades in the three districts. Nevertheless, amaranths contained higher amount of ash at Akron than those of Ouando and Akonaboè ($p>0.05$). Ash is an index of total mineral content and it implies that amaranth and nightshade are better mineral sources. Our results on the ash were in proximity to those reported on leafy vegetables by other authors [21,22]. Ash content refers to inorganic elements such as minerals and leaves were more concentrated in ash than reproductive organs and stem. Also, the ash content depends on genetic, environmental influences and physiology of a plant.

Crude fibre contents ranged from 1.08±0.13% (lettuces) to 1.55±0.32% (amaranths). Crude fibre and carbohydrates of amaranths, lettuces and nightshades showed no difference ($p<0.05$) between the three districts. References [4,27] have reported similar fibre contents of vegetables between 1.2 % and 1.8 %. According to the American Association of Cereal Chemists [28], dietary fibres are the edible parts of plants or analogous carbohydrates that are resistant to digestion and absorption in the human small intestine. Furthermore, it is accepted that vegetables are one of the main source of dietary fibre contributing to about 30-40% of the intake and fibre plays an important role in the prevention of several diseases [29,30].

Macronutrients difference may be due to farming and environmental conditions, plant species or cultivar.

Table 3. Minerals and Heavy Metals Contents of Vegetables (mg/kg dry weight)

	Minerals	Ouando (N=8)	Akron (N=8)	Akonaboè (N=8)	Porto-Novo (N=24)
Amaranth	Iron	135.36±108.32^{a}	33.63±6.20^{b}	34.77±2.48^{b}	67.92±77.19
	Zinc	46.35±17.83^{a}	32.20±8.28^{a}	8.97±4.36^{b}	29.17±19.26
	Calcium	5491.7±1066.12^{a}	4130.9±734.51^{b}	4567.1±1059.22^{b}	4729.9±1089.71
	Potassium	7317.0±1067.86^{a}	5773.8±1173.27^{b}	8708.9±1480.64^{a}	7266.6±1712.52
	Magnesium	1746.9±531.32^{a}	1761.2±679.50^{a}	1548.0±323.62^{a}	1685.3±517.88
	Cadmium	0.0579±0.0661^{a}	0.0000±0.0000^{b}	0.0002±.0002^{b}	0.0194±0.0459
	Lead	0.1188±0.0458^{a}	0.0617±0.0211^{b}	0.0596±0.0115^{b}	0.0800±0.0399
Lettuce	Iron	41.41±8.73^{a}	14.34±6.93^{b}	20.86±6.72^{b}	25.54±13.79
	Zinc	4.93±2.20^{a}	10.66±5.01^{b}	6.41±1.84^{a}	7.33±4.04
	Calcium	2979.2±1042.81^{a}	3646.8±876.03^{a}	3129.1±580.33^{a}	3251.7±867.39
	Potassium	5665.0±1072.82^{a}	3574.5±476.99^{b}	4430.4±723.64^{b}	4556.6±1160.69
	Magnesium	1134.5±346.38^{a}	998.62±254.08^{a}	2323.0±1747.44^{b}	1485.3±1163.94
	Cadmium	0.0005±0.0008^{a}	0.0196±0.0058^{b}	0.0304±0.0131^{c}	0.0168±0.0149
	Lead	0.0833±0.0386^{a}	0.0650±0.0201^{a}	0.0729±0.0329^{a}	0.0737±0.0311
Nightshade	Iron	159.85±63.81^{a}	80.45±23.19^{b}	54.19±24.14^{b}	98.17±60.71
	Zinc	15.73±5.32^{a}	8.29±5.48^{b}	4.25±1.06^{b}	9.42±6.45
	Calcium	4164.6±838.76^{a}	5399.6±1256.27^{b}	3513.2±748.37^{a}	4359.1±1226.17
	Potassium	6090.1±986.65^{a}	6018.6±1112.48^{a}	6600.4±1216.61^{a}	6236.4±1092.45
	Magnesium	1421.2±395.82^{a}	1241.3±426.21^{a}	1129.7±247.26^{a}	1264.0±369.63
	Cadmium	0.0102±0.0046^{a}	0.0112±0073^{a}	0.0011±0.0013^{b}	0.0075±0.0067
	Lead	0.2067±0.0494^{a}	0.2087±0.0847^{a}	0.0192±0.0182^{b}	0.1449±0.1062

Values on a same line followed by the same letter are not significantly different at $p < 0.05$.

3.2. Minerals of Vegetables

The mineral contents of amaranths, lettuces and nightshades leaves differed (Table 3). Iron content ranged from 25.54±13.79 mg/kg (lettuces) to 98.17±60.71 mg/kg (nightshades). Zinc content varied from 7.33±4.04 (lettuces) to 29.17±19.27 mg/kg (amaranths). Iron of amaranths, lettuces and nightshades at Ouando were higher than those of Akron and Akonaboè. Amaranths were found to contain the lowest zinc at Akonaboè, while lettuces contained the highest zinc at Akron and, nightshades concentrated the highest zinc at Ouando. These findings of iron are similar than those found by [22] who reported iron contents between 13 and 85 mg/kg in twenty leafy vegetables in South Africa. For the zinc, these values are lower than those reported in leafy vegetables in South Africa [22] and in India [31]. Mild zinc deficiency can be associated with pregnancy troubles, growth stunted, morbidity and mortality in children. The need of zinc in protein metabolism and nucleic acid synthesis makes its role critical during lactation, pregnancy and childhood. According to [32], iron and zinc present the most prevalent micronutrient deficiency in the world.

Calcium ranged from 3251.73±867.40 mg/kg (lettuces) to 4972.91±1089.71 mg/kg (amaranths). Amaranths contained the highest calcium at Ouando, nightshades concentrated the highest calcium at Akron and, there was no difference of calcium contents in lettuces in the three districts. These values of calcium are lower than those reported by authors in leafy vegetables [22,31,33] and, higher than those reported by other authors in vegetables [4,23,27,34]. Calcium intervenes as a constituent of bones and teeth, and in regulation of nerve and muscle function.

Potassium ranged from 4556.63±1160.69 mg/kg (lettuces) to 7266.56±1712.52 mg/kg (amaranths). Besides these, potassium of amaranths were the lowest at Akron, whereas lettuces had the highest potassium at Ouando and there is no difference of potassium of nightshades in the districts. Potassium contents were in accordance with results found in green leafy vegetables of Mexican, Central American and African [34]. However, authors reported lower results of potassium for leafy vegetables [22,31,33]. Potassium is vital atom for plant growth and intervenes in many biochemical processes as enzyme activation, protein and carbohydrate metabolism. Also, many physiological processes such as stomatal regulation, photosynthesis, abiotic stress tolerance, ion homeostasis and regulation of osmotic balance under salt stress, depend on potassium [35]. It is reported that in human, low potassium intake is associated with hypertension, cardiovascular disease, chronic kidney problem, low bone-mineral density and it worsens the bad consequences of high sodium consumption [36].

Magnesium varied from 1264.03±369.63 (nightshades) to 1685.35±517.88 mg/kg (amaranths). Magnesium of nightshades and amaranths showed no difference in the three districts but, in lettuces magnesium contents were the highest at Akonaboè. Results of magnesium fell within the range of magnesium reported by [34] in vegetables and were higher than those reported by [23] in leafy vegetables in Italy. It is well known that green leafy vegetables are magnesium-rich food and low magnesium intake is associated with problems in the regulation of muscular contraction, blood pressure, insulin metabolism, cardiac excitability, nerve transmission, neuromuscular conduction and other chronic diseases [37].

The three leafy vegetables studied are good sources of iron, zinc, calcium, potassium and magnesium. It is reported that vegetables contribute usually by 35%, 7%, and 24% to the human dietary intake of total potassium (K), calcium (Ca) and magnesium (Mg), respectively [38].

In the vegetables studied, cadmium (Cd) ranged from 0.0075±0.0065 mg/kg (nightshades) to 0.0194±0.0459 mg/kg (amaranths) while lead (Pb) concentration ranged from 0.0737±0.0311 mg/kg (lettuces) to 0.1449±0.1062 mg/kg (nightshades). Even the concentrations of heavy metals (Cd, Pb) were low, Cd and Pb of amaranths were the highest at Ouando and, nightshades contained the highest Cd and Pb at Ouando and Akron. About lettuces, Cd was the highest at Akonaboè and there was no difference of Pb of lettuces in the districts. These results of heavy metals (Cd, Pb) were lower than those reported in vegetables cultivated in Brazil [39]. Cd and Pb are the most toxic heavy metals for man [40] and their main source is anthropogenic activities [41,42]. Highly toxic, these heavy metals don't play any known metabolic role [43,44,45] and they can affect the nutritive values of vegetables and the health of human beings. Leafy vegetables have a tendency to accumulate cadmium (Cd) and lead (Pb) because of their large leaves, high transpiration rate and fast growth rate [46]. Reference [47] reported that vegetables can contribute to about 70% of Cd intake by humans, varying according to the level of consumption and, [48] found that most major cities have been concerned with heavy metals in vegetables. Accordingly, the safe limits of these heavy metals are lowered regularly [49]. It is important to monitor quality of plant, given that plant is one of the main pathways through which heavy metals enter food chain [50]. Cd and Pb found in vegetables of this study in Porto-Novo must be monitored and managed to prevent adverse consequences on human health.

Table 4. Cadmium and lead contents of vegetables, of water and soil

	Concentration		Transfer Factor	
	Cadmium	Lead	Cadmium	Lead
Amaranths (mg/kg) N=24	0.0194±0.0459	0.0800±0.0399	0.0763±0.1910	0.0100±0.0117
Lettuces (mg/kg) N=24	0.0168±0.0149	0.0737±0.0311	0.1873±0.2411	0.0103±0.0134
Nightshades (mg/kg) N=24	0.0075±0.0067	0.1449±0.1062	0.0450±0.0931	0.0065±0.0046
Soil (mg/kg) N=24	0.2691±0.2249	24.3529±16.5994		

3.3 Accumulation of Heavy Metals

Data about cadmium (Cd) and lead (Pb) and, transfer factors of heavy metals are in the table 4. Using Pearson bivariate correlation, there is a positive correlation between Pb of soil and Pb in amaranths, lettuces and nightshades. The correlation is significant at the 0.01 level (2-tailed). About Cd, there is a positive correlation between Cd of soil and Cd of nightshades, lettuces and nightshades. The correlation is significant at the 0.05 level (2-tailed).

The transfer factor from soil-to-leaves of vegetables is defined as the ratio of metal concentration in the plant to the total metal concentration in soil [51,52]. Variations existed in Cd and Pb accumulation capacity in amaranths, lettuces and nightshades. Cd has the greatest potential of accumulation. The results showed that Pb concentration in soil was high (24.35 mg/kg), but transfer factor of Pb from soil to vegetable was much lower than that of Cd. This can be explained by the fact that not all metals found in soil are available to plants and only bioavailable forms can be absorbed. Also, soil might not be the main source of heavy metals in the leaves of vegetables. Heavy metals can penetrate leaves of vegetables by air and water. Lettuces were the strongest accumulator of Cd and Pb. The vegetables are ranked for Cd and Pb accumulation capacity in this following order: lettuce>Amaranth >nightshade. Many factors such as climate, atmospheric depositions, concentrations of heavy metals in soil, nature of soil, edaphic factors, specie and maturity of plants influence the bioaccumulation of metals in plants [53,54,55]. These influences can complicate the identification of patterns of accumulation. In most of cases in the literature, there is no linear dependence between total soil content and plant content of heavy metals [55].

4. Conclusion

The present study has brought in light the nutrients of three leafy vegetables. The three leafy vegetables contain essential nutrients like protein, fat, crude fibre, carbohydrate and minerals. The results highlighted leafy vegetables as sources of nutrients for population of Porto-Novo. Overall, there are differences in the nutrients of *Amaranthus cruentus*, *Lactuca sativa* and *Solanum macrocarpon*. The results suggest that *Amaranthus cruentus* has the high content of nutrients followed by *Solanum macrocarpon* and *Lactuca sativa*. These three leafy vegetables were found to be good source of vital minerals like calcium, magnesium, iron, zinc, potassium and their content in heavy metal (cadmium, lead) are low. Consequently, their cultivation and their consumption are to be encouraged.

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