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RESEARCH ARTICLE

DETERMINATION OF SOME SELECTED MINERALS IN YOUNG LEAVES AND FRUITS OF PUMPKIN *(CUCCURBITA PEPO)* FROM GURAGE ZONE, ETHIOPIA

***[1]Tassew Belete, [2]Arif Abrahim and [1]Tasfaye Hailemariam**

[1]Department of Chemistry (M.Sc in Analytical Chemistry), College of Natural and Computational Science, Wolkite University, Ethiopia
[2]Department of Horticulture (M.Sc in Plant Pathology), College of Agriculture and Natural Resource Wolkite University, Ethiopia

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ABSTRACT

Pumpkin is one of the most economically, nutritionally and medicinally important vegetable crops world wide and grown in temperate and tropical region. The purpose of this study was to determine minerals in its leaf and fruit parts. Samples were collected, grineded and dried at 105 0C. Instruments (AOAC official methode: 923.03-Air–Acetylene FAAS, 923.03-Flame Photometer, ESISO 1871:2013) Agilent technology were used to detect the minerals in the samples. Microwave digestion was used by taking1g sample, 6 mL 70 % HNO3, 1 mL 30 % H2O2 to 60 mL vessels. 50 W, 165 0C (10 min); 80 W, 190 0C (20 min); and 0 W, 50 0C (10 min) were adjusted and clear soltions were kept for analysis by FAAS, Flamephotometry EDTA-titration K (5609.72 mg/kg) > Ca (5290.70 mg/kg) > Mg (2500.24 mg/kg) > Fe (249.64 mg/kg) > Na (98.28 mg/kg) > Zn (48.80 mg/kg) > Mn (38.43 mg/kg) > Cu (12.06 mg/kg) in leaves and Ca (4393.95 mg/kg) >K (3869.21 mg/kg) > Mg (2208.93 mg/kg) > Na (132.87 mg/kg) > Fe (89.89 mg/kg) > Zn (14.18 mg/kg) > Mn (12.70 mg/kg) > Cu (9.38 mg/k) in fruits were determined. Leaves of pumpkin had somewhat higher levels of mineral than fruits and comparable with those of common leafy vegetables. Both parts of the plant (leaf and fruit), are rich in minerals and recommended to be taken for healthiness. Higher potasium content could serve as better diets for hypertensive. High concentration of calcium also indicates that the pumpkin diet could be recommended for a person with tooth and bone problems.

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INTRODUCTION

It is estimated that, up to 2.7 million lives worldwide could potentially be saved each year if fruit and vegetable consumption were increased (WHO, 2003). In Africa, traditional vegetables are an important source of nutrients for the rural population (Mnzava, 1999 and Mosha, 1999). Low fruit and vegetable intake is the 6th main risk factor for mortality in the world. Experts have recommended a daily intake of ~200 g of fruits for healthy living (FAO, 2005 and Agudo, 2005). But data base (Food and Agricultural organization Statistics, 2004), shows East Africa is below this with an average consumption of 36 g of fruits per person per day. Pumpkin (*Cuccurbita pepo*) belongs to the *Cucurbitaceous* family and grows easily from either seeds or cuttings with roots (Gray, 1983).

****Corresponding author:*** **Tassew Belete,**
Department of Chemistry (M.Sc in analytical chemistry), College of Natural, and Computational Science, Wolkite University, Ethiopia

It is among the economically most important vegetable crops worldwide and is grown in both temperate and tropical regions (Paris, 1990; Pitrat, 2002; Ruth, 1998 and Sanjur, 2002). It was originated from Central America *and* dispersed to other continents by transoceanic voyagers since 16th C (Maynard, 1994) Depending upon the species, all parts of the pumpkin plant can used for food. The succulent, tasty leaves, stems, fruit, and nutritious seeds make pumpkin the most popular vegetable to millions of people, ranking as one of the three most widely eaten vegetables at homes and in restaurants (Schippers, 2000). The leafy vegetable produced by *C. pepo* is one of the most palate able leafy vegetables ever known in the South West Nigeria. Vegetable constitutes an important component in man's diet, especially in developing countries. It is needed to complement staples in diet, supplying essential minerals and vitamins that may not be obtained solely from staples. They generally produce more nutrients per unit land area than staples such as rice (Oleyade, 2012). In most regions of Ethiopia, *Cuccurbuita pepo* had been cultivated since several years ago that matured fruit of the plant is used as edible parts. However, in the southern region the young leaf is

cooked lonely or with other vegetables and eaten as delicious traditional food since it is rich in essential nutrition (Zinash, 2013). Different parts of pumpkin have been used as medicine. The pulp of ripe fruit of *Cucurbita pepo* is used to relieve intestinal inflammation or enteritis, dyspepsia and stomach disorders (Sentu, 2008). Past work on the nutrient composition of *Cuccurbita pepo* shows Fruits of *Cuccurbita pepo* provide major micronutrients required for health such as Vitamin C, vitamin A, Vitamin E, iron, phosphorous, calcium, and vitamin B complex (Nyambo, 2005 and FAO, 2006). In leaves of pumpkin, magnesium and calcium are the most prevalent (Aruah, 2011). According to studies (HMPC, 2012), minerals such as phosphorus, potassium, magnesium, calcium, iron, zinc, and trace elements are there in pumpkin. Selenium is of particular importance as its content ranges between 0.08 and 0.4 µg/g, one of the highest values found in plants. The aim of the present study is to determine the concentrations of minerals, namely K, Na, Ca, Fe, Mg, Mn, Zn and Cu in leaves and fruits of some selected varieties of *Cuccurbita pepo* collected from Gurage Zone, Ethiopia. The obtained mean elemental concentrations were compared with the corresponding values of different countries in the literature and the data in leaves of *Cuccurbita pepo* were compared with the common leafy vegetables.

MATERIALS AND METHODS

Description of the Study Area: Gurage zone was the sample areas where a population of pumpkin is cultivated. It is around 170 Km far from the capital city of Ethiopia, Addis Ababa to southwest direction. Geographically, it is located between 7.8^0 - 8.5^0 NE and 37.5^0C - 38.7^0 E longitude of the equator (Abate, 2011).

Materials and Apparatus: Ceramic pestle, mortar were used to ground the sample. PE plastic were used for sample holding. A drying oven was used to dry pumpkin samples. A digital analytical balance was used to weigh pumpkin samples. A microwave digestion with Teflondigestion vessels was applied to digest the dried and powdered pumpkin samples. Volumetric flasks, burret, peppet, measuring cylinder, sample vials to measure volumes of sample and reagents. Instruments (AOAC official method: 923.03-Air Acetylene FAAS, 923.03-Flame Photometer, ESISO 1871:2013). Agilent technology were used to detect the minerals in the samples.

Chemical and Reagents: All reagents that were used in the analysis were analytical grade. Detergent, (72%) HNO_3, (70 %) $HClO_4$ and (30%) H_2O_2 were used for the digestion. Stock standard solutions containing 1000 mg/L of the metals such as K, Na, Ca, Mn, Cu, Fe, Mg, and Zn were used for the preparation of serious calibration standards. Deionized water was used throughout the experiment for sample preparation, dilution, and rinsing apparatus prior to analysis.

Cleaning of glassware and sample containers: All glassware were cleaned with detergent and hot water, rinsed several times with tap water, and then soaked for 12 hours in 10% analytical grade nitric acid solution. Finally, they were rinsed with de-ionised water and dried in the oven at 105 ºC. The plastic containers were cleaned with detergent and tap water, soaked in 1:1 nitric acid. They were then dried in an open rack and stored safely in a locked dust free storage area.

Sample Collection: Young Leafs and ripped fruits of the three pumpkin varieties (Jarrahdale, Porcelain Doll and Sugar pie) was collected from selected districts of Gurage zone where the varieties of the pumpkin is available. The districts selected from Gurage zone were Ezha, Meskan, Cheha, Enemor-ena-ener, Sodo, and Gumer. From each district, three sites were selected. The total sample was six districts x three sites x three varieties totally giving fifty-four (54). The collected leaves and fruits of each varieties of pumpkin obtained from the selected disctricts in the zone were homogenized to get composite sample. Then, they were placed in plastic materials until preparation and analysis.

Sample Preparation: Samples were grinded, dried, and powdered to be ready for digestion. Microwave digestion was used for sample preparation. A 1 g of dried and powdered sample was transferred into 60 mL vessels. Optimized volumes of 6 mL of 70 % nitric acids and 1 mL of 30 % hydrogen peroxide was added and the mixture was shaken carefully. It was kept for 10 min before closing the vessel and subjected to microwave digestion program in the sequence of 50 W, 165 ^{0}C (10 min); 80 W, 190 ^{0}C (20 min); and 0 W, 50^0C (10 min) and the clear solutions obtained were kept for analysis.

Digestion of the Blank Samples: Digestion of reagent blank was also performed in parallel with each of the pumpkin samples keeping all digestion parameters the same. For the analysis of each pumpkin samples, eight reagents blanks were prepared. All the digested samples were stored in refrigerator until the analysis.

Instrument Operating Conditions: In the use of FAAS for minerals, analysis optimization of the operating conditions is very critical. Wavelength, energy, lamp and burner alignment and slit width were optimized for Zn, Mn, Cu and Fe analysiis. Offical methode 923.39-EDTA-titration, Na and K were also determined by using the modified AOAC-923.03-Flame photometer methods (AOAC.1990). Standards used in establishing the analytical curve for these mineral determinations were prepared from 1000 mg/L standard stock solutions (Agilent's calibration standards, UK). The working solutions (500 mg/L) of each metal were then freshly prepared by diluting the stock solution in 1000 mL volumetric flask with deionized water. Acceptability of linearity data is often judged by examining correlation coefficients (Table 2.2).

Method validation: Method validation is the process of providing that analytical method is acceptable for its intended purpose. Because of the absence of certified reference material for the pumpkin samples in our laboratory, the validity of the optimized digestion procedure was assured by spiking the samples with a standard of known concentration of the analyte metals.

Statstical Analysis: The statistical analyses of the results were done using the statistical software like excel to analyze the generated data during experimentation. The statistical analyses were conducted using statistical package of microcal origin 6.1. First class ANOVA was made to check whether there is significant difference or not between means at 95% confidence interval. Calibration graphs and bar graphs were drawn using Microsoft Office Excel 2007 and microcal origin 6.1.

Table 2.1. Instrumental operating conditions for the determination of minerals by FAAS

Minerals	wavelength[nm]	Slit width [nm]	Lump current [mA]	IDL [mg/L]	Energy [eV]
Mn	279.5	0.2	2.0	0.001	3.971
Cu	324.7	0.4	3.0	0.005	3.327
Fe	248.3	0.4	0.2	0.03	3.327
Zn	213.9	0.4	3.0	0.005	3.047

IDL = instrument detection limit

Table 2.2. Standard solution and correlation coefficient

Element	Concentration of inermediate atandard [g/kg]	Concentration of working standard[mg/Kg]	Correlation Coefficient curve
Mn	50	0, 0.25, 0.5, 1, 1.5, 2	0.99860
Zn	50	0, 0.125, 0.25, 0.5, 0.75, 1	0.99764
Cu	50	0, 0.25, 0.5, 1.5, 2	0.99984
Fe	50	0, 0.5, 1, 2, 3, 4	0.99776
Na	50	0, 2, 4, 6, 8, 10.	0.99979
K	50	0, 2, 4, 6, 8, 10	0.99987

I.S = intermed.stand., W. S = working stand., C = Correlation

Table 2.3. Recovery experiment of pumpkin sample for mineral analysis in [mg/Kg]

Metals	[a]Conc. in sample	Amnt added	[b]Conc. in spiked sample	[c]Recovery (%)
Mn	39.26	10	49.23 ± 0.47	99. 70 ± 4.70
Zn	49.66	13.5	63.37 ± 0.38	101.56 ± 2.83
Cu	13.26	5	18.12 ± 0.14	97.27 ± 2.881
Fe	254.33	65	317.29 ± 0.45	96.87 ± 0.70
Na	129.63	50	181.50 ± 0.94	103.74 ± 1.87
K	5833.33	1000	5938.76 ± 7.02	105.37 ± 0.70

[a]Mean concentration of Jarrahdale leave samples analyzed in triplicate
[b] Mean concentration ± SD of samples spiked in triplicate
[c] Mean recovery ± SD of percentage recoveries of triplicate analyses

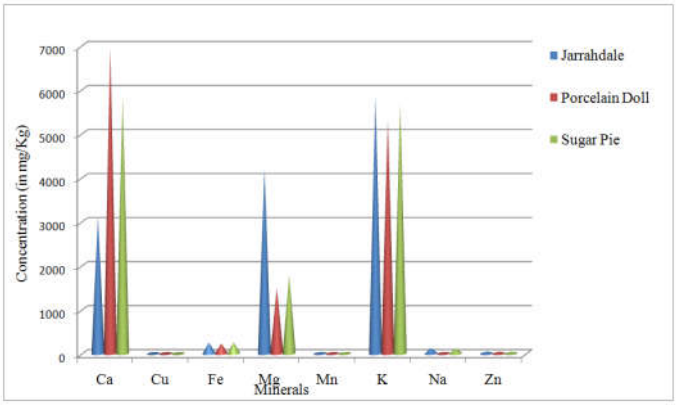

Figure 3.1. Distribution of minerals concentration in leaves of the three varieties of pumpkin

RESULTS

Determination of some minerals in leaves of Pumpkin: In (Table 3-1) at the back, the concentration of some minerals in leaves of the varieties were described by taking the triplicate samples of each variety. Accordingly, K and Ca metal were higher value in leaves of all varieties of pumpkin that is 5314.86 ± 1.29, 5680.97 ± 3.83, and 5833.33 ± 4.48 mg/Kg of K and 6949.64± 1.80, 5811.35 ± 1.07and 3111.11 ± 0.36 of Ca in leaves of Porcelain Doll, Sugar pie and Jarrahdale varieties respectively. Cupper was the least in leaves of all varieties of pumpkin which is ranged from 11.18 ± 0.06 mg/Kg (Porcelain Doll) to 13.26 ± 0.11 mg/Kg (Jarrahdale). Leaves of Porcelain Doll (6949.64 ± 1.80 mg/Kg) and Sugar pie (5811.35 ± 1.07) variety is high in Calcium and low in Cupper. In this variety, manganese (38.56 ± 0.47 mg/Kg) and sodium (38.56 ± 4.08 mg/Kg) were almost the same in concentration.

Where as Zn, Fe, and Mg were 46.94 ± 2.70, 233.93 ± 2.69 and 1496.37 ± 2.49 mg/Kg respectively. The variety of Jarrahdale pumpkin has Fe with 254.33 ±2.75 mg/kg, Zn, Mn and Na metals were also determined and respectively gave 49.66 ± 2.79, 39.26 ± 0.28 and 129.63 ± 3.82 mg/kg. In Sugar pie of pumpkin plant, Fe, Zn, Mn and Na were determined as 260.6± 1.16, 46.81 ± 1.15, 37.48 ± 0.82 and 126.66 ± 6.29 mg/kg respectively.

Determination of some minerals in Fruits: As it was indicated in (Table 3-2) at the back, the fruit of Porcelain Doll varieties of pumpkin had 15.00 ± 0.61, 15.40 ± 0.80, 16.41 ± 0.42, 141.01 ± 4.00, 168.73 ± 2.67, 1568.34 ± 4.31, 3585.59 ± 4.48,5770.69 ± 2.59 mg/Kg concentrations of Zn, Cu, Mn, Fe, Na, Mg, K and Ca metals respectively ranging from the least to the largest values. In this variety of pumpkin, Zn which was comparable with Mn and Cu was the least in concentration whereas Ca was the largest of all elements determined this variety.

Table 3.1. Average concentrations of minerals in Leaves of three varieties of Pumpkin in [mg/Kg] ± SD, n=3)

Minerals	Concentration (mg/kg)		
	Jarrahdale	Porcelain Doll	Sugar Pie
Ca	3111.11±0.36	6949.64±1.8	5811.35±1.07
Cu	13.26±0.11	11.18±0.06	11.73±0.16
Fe	254.33±2.75	233.93±2.69	260.65±1.16
Mg	4212±3.12	1496.37±2.49	1792.36±2.03
Mn	39.26±0.28	38.56±0.47	37.48±0.82
K	5833.33±4.48	5314.86±1.29	5680.97±3.83
Na	129.63±3.82	38.56±4.08	126.66±2.81
Zn	49.66±2.79	46.94±2.7	46.81±1.15

Table 3.2. Average concentrations of minerals in Fruits Pumpkin in [mg/Kg] ± SD, n=3

Minerals	Concentration		
	Jarrahdale	Porcelain Doll	Sugar Pie
Ca	3061.22 ± 3.96	5770.69 ± 2.59	4349.93 ± 2.43
Cu	6.44 ± 0.12	15.40 ±0.80	6.30 ±0.36
2Fe	55.91 ± 2.60	141.01 ± 4.00	72.76 ± 4.88
Mg	3296.73 ± 4.63	1568.34 ± 4.31	1761.72 ± 0.34
Mn	9.88 ± 0.26	16.42 ± 0.42	11.8 ± 0.05
K	3188.77 ± 4.46	3585.59 ± 4.48	4833.25 ± 4.33
Na	88.90 ± 0.79	168.73 ± 2.67	140.97 ± 3.24
Zn	13.96 ± 0.73	15.00 ± 0.61	3.57 ± 0.44

Table 3.3. Average Contents of Minerals in the three varieties of pumpkin in [mg/Kg]

S.N	Minerals	Concentrations (mg/Kg)	
		Leaves	Fruits
1	Ca Cu	5290.7	4393.95
2	Cu	12.06	9.38
3	Fe	249.64	89.89
4	Mg	2500.24	2208.93
5	M n	38.43	12.7
6	Na	98.28	132.87
7	K	5609.72	3869.21
8	Zn	47.8	14.18

Table 3.4. Comparison of minerals with the available data done in different countries

Country	Parts	Ca	Cu	Fe	Mg	Mn	Na	K	Zn	Ref.
Ethiopia [mg/100g]	Leave	5290.7	12.06	249.64	2500.24	38.4	98.28	5609.72	47.8	Present study
	Fruit	4393.95	9.38	89.89	2208.93	12.7	132.87	38692.06	14.18	
Nigeria [mg/100g]	Seed	9.78	NR	3.75	67.41	0.06	170.35	237.24	14.1	[33]
	Leaves	61.03	0.93	5.75	61.03	NR	51.49	352.0	13.15	[34]
Zimbabwe [mg/100g]	Seed	141	NR	11.98	344.6	NR	67.956	NR	1.2	[35]
Egypt [mg/100g]	Fruit	166.4	1.82	7.56	302.63	0.54	226.29	3623.6	4.57	[36]
Nigeria [mg/Kg]	Fruits	179.01	3.910	1.370	189.91	0.502	159.01	160.31	NR	[37]
Kosovo [mg/Kg]	Fruit	23.82	1.17	2.87	4.02	NR	1.89	NR	1.32	[38]

Table 3.5. Comparison of Minerals in Leaves of Pumpkin with Common leafy Vegetables

Vegetables	Ca	Cu	Fe	Mg	Mn	Na	K	Zn	Ref.
Cuccurbita Pepo [mg/100g]	529.07	1.206	24.96	250.24	3.843	9.828	5609.722	4.780	Present study
Bitter Leaf [mg/100g]	71.50	1.06	16.43	61.08	3.16	2.76	73.25	18.15	[39]
Indian spinach [mg/100g]	61.19	0.14	34.47	NR	2.54	15.01	16.85	3.73	
Bushbuck [mg/100g]	72.65	ND	18.41	92.51	5.46	32.97	99.01	12.49	
Scent leaf [mg/100g]	64.80	5.69	23.36	88.25	4.60	84.10	86.24	6.85	
Amaranths Hybrids[mg/100g]	70.40	0.08	39.04	249.92	10.06	88.00	168.96	21.68	
Hibiscus sabdariffa [mg/100g]	110.16	3.14	21.84	120.09	6.14	46.98	84.11	15.43	
Telfairia Occidentalis [mg/100g]	519	NR	NR	25		98	742	NR	[40]
Moringa Oleifera [mg/100g]	906	NR	NR	333		132	667	NR	
Brassica oleracea [mg/100g]	387	NR	NR	237	NR	170	1917	NR	

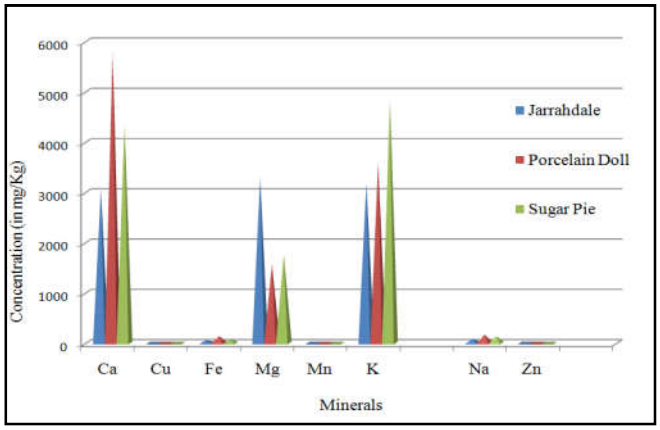

Figure 3.2. Distribution of mineral concentrations in Fruits

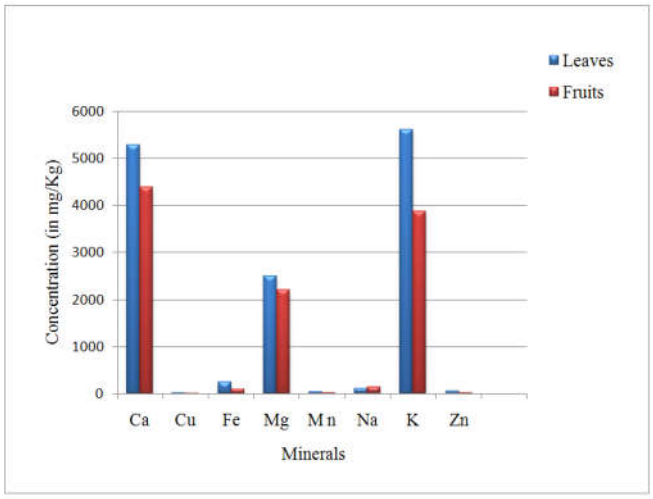

Figure 3.3. Distribution of minerals in leaves and fruits of pumpkin

The concentration of elements in the fruits of Jarrahdale variety of pumpkin was also ranged from the least to the largest as 6.44 ± 0.12, 9.88 ± 0.26, 13.96 ± 0.73, 55.91 ± 2.60, 88.90 ± 0.79, 3061.22 ± 3.96, 3188.77 ± 4.46, 3296.73 ± 4.63, mg/Kg for Cu, Mn, Zn, Fe, Na, Mg, K and Ca respectively. In the fruit of this variety, Cu was the least in concentration and K was the leading one. The fruit of pumpkin called Sugar pie had also these elements in increasing order as 6.30 ± 0.36, 11.8 ± 0.05, 13.57 ± 0.44, 72.76 ± 4.88, 140.97 ± 3.24, 1761.72 ± 0.34, 4349.93 ± 2.43, and 4833.25 ± 4.33 mg/Kg for Cu, Mn, Zn, Fe, Na, Mg, Ca and K respectively. The order of Cu, Mn, and Zn in fruits of Sugar pie was the same with those in fruits of Jarrahdale nevertheless Zn was the first in low concentration for Porcelain Doll variety and Ca element was again the largest element in concentration. As it was seen in leaves of all varieties of pumpkin under study, K and Ca were largest element in concentration for fruits of all varieties studied in the present study.

DISCUSSIONS

Among the varieties, Jarrahdale was the dominating one (almost higher in all elements) in minerals determined. Leaves of these three varieties are rich with mineral concentration under study. They have the similarity with common vegetables in nutritional value since they had enough minerals, which are essential for the life. The significance of variation between samples for the concentration of minerals were analyzed using one-way ANOVA. Thus, there was no significant difference ($p > 0.05$) among leaves of all varieties in means of Ca, Mn, and Zn, but there was significance difference ($P < 0.05$) among all varieties in means of Cu, Mg, Fe, Na, and K. The significance difference was because of the presence of different values of minerals in defferent varieties of the pumpkin genotype. There was a significance difference ($P < 0.05$) of means of all minerals in fruits among the three varieties of pumpkin except Zn which its mean was not significantly different ($P > 0.05$) between Jarrahdale and Sugar pie even significance difference was there in means of Zn between Jarrahdale and Porcelain Doll as well Sugar pie and Porcelain Doll.

Average level of Minerals in Leaves and Fruits from the three varieties of pumpkin: The average minerals contents, determined in the leave and fruit parts of pumpkin were reported as (Table 3-3). Accordingly, Ca was 5290.7 mg/Kg in leaves and 4393.947 mg/Kg in fruits of selected varieties of pumpkin. It plays an important role in building strong as well as in the keeping healthy bones and teethes at both early and later life shows more in leaves (Yahaya, 2014). Thus, it may be recommended to take pumpkin food for a person with bone and teeth problems since the value of Ca in the present study was high enough. Iron (Fe), which is the trace essential was greater in leaves (249.64 mg/Kg) and low in fruits (89.89 mg/Kg) of pumpkin. Iron is a micronutrient required for hemoglobin production and is the constituent necessary for the transportation of oxygen in the body. It is also a cofactor for several important enzyme activities (Ogbede, 2015). The recommended daily intake of Fe is low as 8 mg/day and the value in this study is not a concern for its toxicity except its importance as of micronutrients. The concentration of Zn in pumpkin was also determined and reported as 47.80 mg/Kg in leaves and 14.18 mg/Kg in fruits. The recommended daily allowance (RDA) for Zn metal is 15 mg/day (Farid, 2004), and the values in the present study are within the range of this value from the daily intake of pumpkin point of view. Pathak and Kapil, (Pathak, 2004), reported that zinc is vital in protein synthesis, cellular differentiation and replication, immunity and sexual functions. The pumpkin plant may be selected as a good source of Zn. Magnesium (Mg) is the major essential element and concentrated more in leaves (2500.24 mg/Kg) and less in fruits (2208.93 mg/Kg) of pumpkin. Mg is widely distributed in plant and animal foods and geochemical and other environmental variables rarely have a major influence on its content in foods. Most green vegetables, legume seeds, peas, beans and nuts are rich in Mg as are some Shwelfish, Spices and Soya Flour, all which usually contain more than 500 mg/kg Fresh Weight (FNB, 2012). Therefore, the high values of Mg in the present study were due to its accumulation highly in plants (pumpkin). Mn, which was more 38.43 mg/kg in leaves and very low (12.7 mg/Kg) in fruits of pumpkin. Manganese is involved in enhancement of normal skeletal growth and development, and also functions with vitamin K in the formation of prothrombin. It is also an important cofactor for many enzyme activities (Ogbede, 2015). The level of Cu is very high in 12.06 mg/Kg in leaves and 9.06 mg/Kg in fruits of pumpkin compared to acceptable range set by WHO of 2-5 mg intake per day (Anonymous, 1998). It is involved in the process of erythropoiesis, erythrocyte function, and regulation of red blood cell survival. However, high concentration in the system can lead to diarrhea, epigastric pain and discomfort, blood in the urine, liver damage, hypotension and vomiting. It has been reported that Cu consumption in excess of 3 mg/L of drinking water result in nausea and other adverse effects on the gastrointestinal tract. The presence of excess Cu can cause

oxidative stress in plants and subsequently increase the antioxidant responses due to increased production of highly toxic oxygen free radicals. The value in the present study was not as high as toxic limit and categorized as within the range of permissible limit considering the average daily intake of pumpkin. Sodium (Na) was less (98.28 mg/Kg) in leaves and high (132.86 mg/Kg) in fruits of pumpkin. Sodium is required by the body to regulate blood pressure and blood volume (Akpanyung, 2005). The dominated minerals in concentration was potassium, which was more in leaves (5609.72 mg/Kg) and less in fruits (3869.21 mg/Kg). The potassium content of leafy vegetable is good in the control of diuretic and hypertensive complications (George, 2003). Sodium to potassium ratio of less than one has been recommended for the prevention of high blood pressure (FND, 2002). Thus, the consumption of pumpkin could probably serve to reduce high blood pressure diseases in the human body, due to the less than one value obtained for their Na/K ratio. In general, the leaves of pumpkin are relatively high in contents of mineral when compared with those in fruits. The high level of calcium and potassium in both leaves and fruits of pumpkin were because; they are major essential element and concentrated broadly in common food. The pumpkin food is also very high in concentrations of major essential elements Ca, Na, Mg, K and has enough values of trace essential elements (Zn, Cu, Mn and Fe). Therefore, the pumpkin plant may be considered as nutritionally rich, preferable for health packages in line with the nutritional constituents and prepared as delicious food in different hotels and food producing area in the country. There are wide variations in the published data for the elemental concentrations of pumpkins of different countries as shown in Table 3-4. The unit of the present study mg/kg was converted to mg/100g for the sake of making similar with the literature values. The concentration of Ca in leaves (529.07 mg/100g) and in fruits (439.39 mg/100g) of the present study was very high compared with the corresponding values of other countries. This data shows that the pumpkin in the present study area is rich in calcium. The concentration of Cu (1.21 mg/100g) lower than the corresponding countries except in leaves from Nigeria (0.93 mg/100g) which was lower. The result of Fe (24.96 mg/100g) in leaves and (8.99 mg/100g) in fruits is higher than the values of different parts from all corresponding countries reported in Table 4-10 below.

Magnesium concentration (250.02 mg/100g) in leaves and (220.89 mg/100g) in fruit were higher than in seed (67.41 mg/100g), fruits (189.910 mg/100g) and leaves (61.03 mg/100g) from Nigeria, 4.02 mg/kg in fruits from Kosovo. The concentration of Mn in leaves (3.84 mg/100g) in leaves and fruits (1.27 mg/100g) are higher than all results from the corresponding countries. Sodium (9.83 mg/100g) in leaves and (13.29 mg/100g) in fruits are lower than the result in pumpkin from almost all countries in the table except the one from Kosovo which is lower (1.89 mg/kg). The results of K (560.97 mg/100g) in leaves and (386.92 mg/100g) in fruits are higher than the reported data in the table indicating the pumpkin of the present study is very high in concentration of potassium. Zink in leave (4.78 mg/100g) and fruit (1.42 mg/100g) are less than in seed and leaves from Nigeria, and seeds from Zimbabwe where as higher than the result in fruits from Kosovo having (1.32 mg/kg). In general, the concentrations of minerals detected in the present study were more or less comparable with the reported literature values. However, relatively higher concentrations of K and Ca were observed in this study in comparison to the reported values.

Comparison of the Level of Minerals in leaves with available result in Common leafy Vegetable: As indicate in (Table 3-5) below, the mineral concentration of leaves of pumpkin is more or less comparable with the common leafy vegetables. The Ca concentration (529.07 mg/100g) is more than all of the common leafy vegetables reported in the table. Cur (529.07 mg/100g*)* is more than in *Bitter Leaf (*1.06 mg/100g), *Indian spinach* (0.14 mg/100g), *Amaranths hybrids* (0.08 mg/100g) *and Telferia Occidentalis* (0.33 mg/100g) whereas lower than in *Scent leaf* (5.69 mg/100g) and *Hibiscus Sabdarrifa* (3.14 *mg/100g*). Concentration of Fe (24.964 mg/100g) comparable having the same series with vegetables reported in the table. Mg (250.24 mg/100g) is highly comparable with in *Amaranths hybrids* (249.92 mg/100g) and higher than other vegetables except *Telfaria occidentals* (288.65 mg/100g). Mn and Zn are also in the same series with vegetables in the table but the concentration of K in, leaves of pumpkin is very higher than all vegetables reported in the table. In general, the mineral concentration in leaves of pumpkin is comparable with those in edible common leafy vegetables and the leaf of pumpkin cuold be considered as a good edible leafy vegetable.

Conclusion

The research work is to contribute understanding mineral concentration of pumpkin constituents in leaf and fruits parts of pumpkin. Leaf has somewhat higher levels of mineral than fruits and comparable with those of common leafy vegetables. Both parts of pumpkin vegetable are rich in minerals and reccommended to be taken for healthiness. The values are more or less comparable with the data reported by different researchers in different country. Among the three varieties of pumpkin, Jarrahdale was the dominating one by minerals in both leaves and fruits. The leaves are good source of Fe, Cu, K, and Mn, which meet the recommended daily allowance. Higher Potassium content further confirmed that the leaves of this plant could serve as better diets for hypertensive. High concentration of Ca indicates that the pumpkin diet could be reccommended for a person with tooth and bone problems.

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