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Determination of iron content in selected indigenous green leafy vegetables in Baraton, Kenya.

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Abstract: A study was done to determine the level of iron in selected indigenous vegetables using UV-vis spectrophotometric method. The four indigenous vegetables that was frequently consumed by Baraton families were; amaranths, pumpkin leaves, spider plant, and *bacella alba*, were selected for the study. Absorbance measurement was done on the ash samples of cooked and uncooked vegetables using UV-Vis spectrophotometer at 458 nm. The results showed among the uncooked vegetables, the iron concentration ranged from 0.081 to 0.23 ppm with pumpkin leaves and *baccela alba* recording the lowest and highest level respectively. The cooked vegetables had Fe levels ranging for 0.041 ppm to 0.43 ppm with pumpkin leaves and amaranths having lowest and highest Fe levels respectively. One sample t-test analysis showed that there was no significant difference between the Fe levels in the cooked and uncooked vegetables P>0.05. The findings showed that the sampled vegetables are a source of iron in diet.

Key words: Iron; UV-Vis spectrophotometer; indigenous vegetables

Introduction

Many people in Kenya are undernourished, especially children being weaned and pregnant and lactating mothers and nutrient-deficiency diseases such as night blindness, scurvy and rickets are common in rural areas and slums. To counter these nutritional problems, it is important that the most commonly consumed foods should be nutritious. Since vegetables are consumed frequently and in large quantities, those which provide most of the required nutrients should be favored. Nutritional studies have been done on the priority indigenous vegetables, including mineral analysis (Abukutsa-Onyango, 2011)

Traditional vegetables are valuable sources of nutrients (Nesamvuni C., Steyn N.P., Potgieter M.J., 2001); (Yang R.Y., Keding G.B., 2009), with some having important medicinal properties (Hilou A, 2006). Vegetables contribute substantially to food security (Yiridoe E.K., Anchirinah V.M., 2005). Overcoming food and nutritional insecurity among women, pregnant and lactating mothers, and children under five years of age, remains a challenge in many developing countries in sub Saharan Africa (Anderson L.T., Thilshed S.H, Nielsen BB, Rangasamy S, 2003).

Indigenous green leafy vegetables include the vegetables that are both domesticated or growing wild in areas with disturbed soils or agricultural activity. The wild varieties grow naturally in the bush and do not have to be tended for them to produce edible parts. Semi-Wild semi-cultivated on the other hand is vegetables which are protected when they grow near homes or in the home gardens (Vorster, I.H.J., Jansen Van Rensburg, W.S., and Ventor, S.L., 2007). Topping, the removal of the apical stem, could be used to delay flowering in some of the indigenous vegetables that flower early, such as spider plant, and increases productivity. (Abukutsa-Onyango M., 2003). Many of these varieties have been domesticated by many communities where inorganic or organic fertilizers are added to improve their yields (Vorster H. S., 2008). Indigenous leafy vegetables are all plants, whose leaves, roots or fruits are acceptable and used as vegetables by rural and urban populations through tradition, custom and habit (Redzic, 2006). These vegetables are widely consumed, especially during famines and natural disasters when cultivation of other vegetables is not possible.

Kenyans especially favor East African leafy greens. They are almost all a rich green color and have a bitter taste. Spider plant, pumpkin leaves, African nightshade and amaranth leaves are among these greens. Spider plant is known for its sour taste, and bacella Alba, which is also popular in the region, has a slimy texture when cooked that people either hate or love. *Bacella Alba* is one of Kenya's most nutritious vegetables, has medicinal benefits, and is commonly grown in several parts of the world. Research also shows that amaranth greens, spider plant and Pumpkin leaves are high in antioxidants such as vitamins A, C, and E, and also contain high amounts of ferrous and calcium. (Judith Kimiywe, Judith Waudo, Dorcus Mbithe, and Patrick Maundu., 2007).

Vegetables are known to be important sources of protective foods (Nnamani, C.V., Oselebe, H.O and Agbatutu, A., 2009); and (Sheela, K., Kamal, G.N., Vijaylaksmi, D., Geeta,M.Y., Roopa, B.P., 2004). Vegetables have also been reported to be good sources of oil, carbohydrates, minerals as

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well as vitamins (Adernipekun, C.O. & Oyetunji, O.J., 2010). According to George (2003), the potassium content of leafy vegetable is good in the control of diuretic and hypertensive complications. For a long time, agricultural policies in many states advocated the use of exotic species at the expense of indigenous ones. Recently, indigenous vegetables have won some recognition through crop research at international, regional and national institutions. (Cernanisky, 2015)

The marketing system has remained informal, with economic inefficiencies. Neglect and stigmatization, non-availability of high-quality seed and planting material, inadequate awareness of value and potential of indigenous fruits and vegetables, lack of agronomic and processing technical packages, short shelf life, inadequate research, knowledge-sharing and training and a lack of transparency about intellectual property rights to guide their use, especially those collected in the wild are additional constraints. (Onyango, C.M., Shibairo, S.J., Imungi, J.K. and Harbins J., 2008).

Materials and Methods

Materials

The research was done at the University of Eastern Africa, Baraton. The indigenous vegetables were bought from the university supermarket and the Baraton center market. The vegetables grow by cultivation and natural occurrence. The chemicals that were used included ferrous nitrate solution, potassium thiocynatate, hydrochloric acid and distilled water. The food items used in this experiment were; spider plant, pumpkin leaves, amaranths and bacella Alba, cooked and uncooked.

Preparation of the standards

The standards were prepared by using iron nitrate which was prepared to 0.001M. The 0.001M was then used to prepare different concentrations by measuring 5ml, 10ml, 15ml and 20ml into different test tubes. To test tube 1, no iron nitrate was added. To test tube 2 5ml was added, and to test tube 3, 5, and 5, 10ml, 15ml, and 20ml were added consecutively. To test-tube 1, 20ml of 0.1M HCl was added. To test tube 2, 3, 4 and 5, distilled water was added 15ml to test tube 2, 10ml to test tube 3, 5ml to test tube 4 and none to test tube 5. 2.5ml of 0.1M KCSN was added to each test tube which was to form a red color to confirm formation of $FeSCN^{2+}$ ion.

Preparation of the food samples

2.5g of the solid food samples were weighed and placed into a crucible. The crucibles were then heated with a hot burner flame until the food sample turned to ash. The time for heating was 20 minutes. The burner was removed and the samples were allowed to cool. They were transferred to small beakers. 10ml 0f HCl was carefully added to the beakers and stirred to the beakers too and mixing was well done. The ware then filtered to collect the filtrate. 2.5ml of 0.1 KCSN was added to each filtrated.

Finding the absorbance

A wavelength of 458nm was used in the UV-Vis. The standard solutions were then placed in different curettes and also food samples in different curettes. The absorbance was then measured and recorded.

Data analysis

A standard curve (Beers law) of the standard concentrations verses absorbance was used to find the concentrations of the food samples. One sample t-test was performed to compare the level of iron between the cooked and uncooked vegetable samples.

Results and Discussion

The results of the study showed that among the uncooked vegetables, the iron concentration ranged from 0.081ppm to 0.23 ppm with pumpkin leaves and *baccela alba* recording the lowest and highest level respectively. The cooked vegetables had Fe levels ranging for 0.041 ppm to 0.43 ppm with pumpkin leaves and amaranths having lowest and highest Fe levels respectively. The results in this research show that all the four selected vegetable had iron of varied concentrations.

The Fe composition of the vegetable (Table 2) unravels a high concentration of iron. Children, women of reproductive age and pregnant women are most vulnerable to micronutrient deficiency and anemia (Ghana Demographic and Health Survey (GDHS). Ghana Statistical Service (GSS), Noguchi Memorial Institute formedical research (NMimR), and ORC Macro. Calverton, Maryland: GSS, NMIMR, and ORC Macro., 2003, 2004). Hence, they need food with high iron content. When these green leafy vegetables with enough iron content are eaten in dishes, there is no need for iron supplements. There is a risk of iron toxicity when iron supplements are over- dosed which results in damage to liver and pancreas, and even sudden death in young children (Estelle L. and Kave M., 1999).

Recently there is a trend in the production and consumption of indigenous leafy vegetables as these have been found to be both nutritive and therapeutic. Indigenous leafy vegetables play a significant role in the nutrition and health status of the under privileged in both urban and rural settings (Gackowski J, Mbazo J, Mbah G and T Moulende, 2003).

Table 1a: Table showing Fe concentration for uncooked vegetable

Vegetables	Absorbance	Concentration (ppm)
Amaranths	66.566	0.227
Pumpkin Leaves	76.5	0.081
Spider Plant	62.233	0.227
Bacella Alba	61.933	0.23

Table 1b: Table showing Fe concentration for cooked vegetable

Vegetables	Absorbance	Concentration (ppm)
Amaranths	42.3	0.43
Pumpkin Leaves	80.4	0.041
Spider Plant	89	0.046
Bacella Alba	62.133	0.228

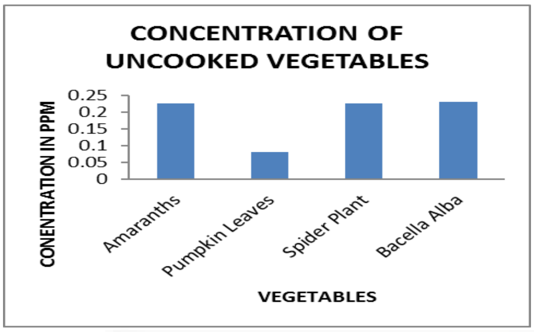

Figure 2: Bar graph showing concentrations of Fe in uncooked vegetables

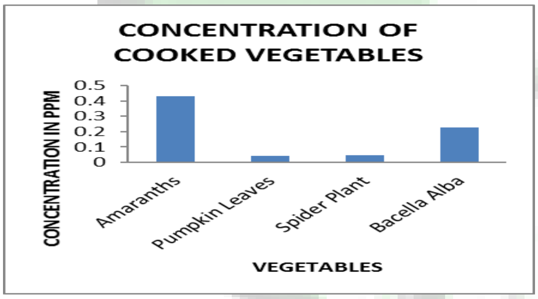

Figure 3: Standard curve for the Fe standard.

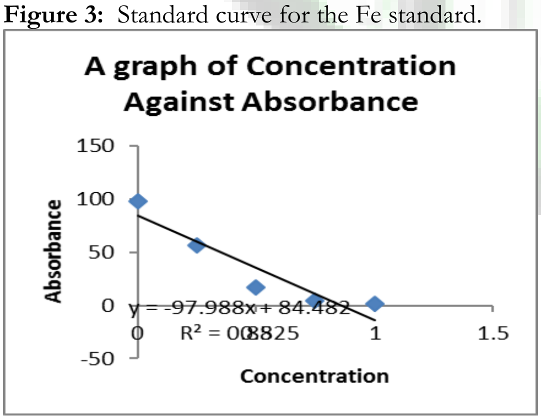

Table 2: Paired sample t-test statistic

Paired Samples Statistics		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Uncooked	.1913	4	.07351	.03676
	Cooked	.1863	4	.18432	.09216

Paired Samples Test	Paired Differences					T	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Uncooked - Cooked	-.00500	.15861	.07931	-.24739	.25739	.063	3	.954

The results study of the showed that among the uncooked vegetables, the iron concentration ranged from 0.081ppm to 0.23 ppm with pumpkin leaves and *baccela alba* recording the lowest and highest level respectively. The cooked vegetables had Fe levels ranging for 0.041 ppm to 0.43 ppm with pumpkin leaves and amaranths having lowest and highest Fe levels respectively. The results in this research show that all the four selected vegetable had iron of varied concentrations.

One sample t-test analysis was performed and it showed that there was no significant difference between the Fe levels in the cooked and uncooked vegetables $p>0.05$. Results from this study compared well with the study done by (Weinberger K., Msuya J, 2004) who found the level of Fe in amaranth to be 229.5µg·g.

Recently there is a trend in the production and consumption of indigenous leafy vegetables as these have been found to be both nutritive and therapeutic. Indigenous leafy vegetables play a significant role in the nutrition and health status of the under privileged in A nutritional evaluation of indigenous vegetables in Kenya considered that the nutritional contribution of cooked and uncooked vegetables was enormous (Habwe, 2010) and (Abukutsa, 2010). Nightshade and cowpea contained iron levels that would provide 100% of the recommended daily allowance and 50% for protein. Indigenous vegetables cooked with lye (traditional salt) had higher iron content than cooked ones both urban and rural settings (Gackowski J, Mbazo J, Mbah G and T Moulende, 2003).

Conclusion

The present study revealed that the selected African indigenous vegetables are a good source of Fe and that cooking does not alter the Fe content. Further studies on other nutrients should be done on the indigenous vegetables. This will help the consumers since obtaining information and promoting knowledge about high value of nutrients-rich indigenous vegetables could potentially address some health challenges. Increasing the production of indigenous vegetables and informing people how to pre- pare vegetables to gain maximum nutritional value will help ensure low cost nutrients reach vulnerable populations and enhance food and nutritional.

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