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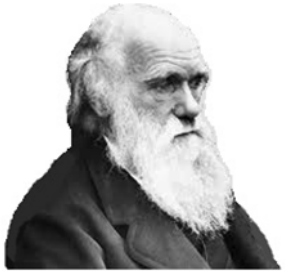

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Photochemical investigation of *Abelmochus esculentus*

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ABSTRACT

Okra is an edible fruit that is commonly known as a vegetable. It is available in most parts of the world generally throughout the year. The scientific name of okra is '*Abelmochus esculentus* or *Hibiscus esculentus*. The different varieties of this fruit are reflected in variation in shape, size and, more importantly, taste. Okra is known by different local names in different countries. Since okra has very interesting nutritional properties, it has attracted research. In the present study, attention has been paid to investigate the nutrients it holds that are essential for a healthy body. Flame absorption spectrophotometer was used to ascertain Ca, Cr, Cu, Fe, Mg, Mn, Pb, and Zn content. The amount of calcium was found highest at 4582.85 mg/kg, 1067.23 mg/kg and 1816.37 mg/kg in raw pod flesh, unripened seeds and ripened seeds, respectively. Pb and Cr were not detected at all, while the highest value of nitrogen (4.32%) was found in unripened pods.

***Keywords*:** Okra, *Abelmochus esculentus*, Nutrients, AAS

1. INTRODUCTION

Okra is an edible green fruit but commonly known as a vegetable. Its scientific name is "*Abelmochus esculentus*" and also as "*Hibiscus esculentus*". It is known by different local names such as Ladies Finger, Bhindi, okoro and others in different parts of the world. Different scientist have given different names on their own ideas of the family. The first part is the family name and the second part is the name of the species. Okra grows in a warm climate. The seeds are planted directly in the ground. Most varieties will start yielding about

60 days after planting. The flowers are pale yellow and large. Each flower blooms for only one day and eventually forms one okra pod. The plant size is the maximum of 10 feet.

The length depends on the variety. Okra commonly used both as food and also as salad and curative properties showing low calories, and fibre contains bioactive compounds such as carotene, folic acid, riboflavin, niacin, thiamin, oxalic acid, vitamin c and amino acids [1].

The seeds of okra have a lower content of calcium, magnesium and potassium in comparison to leaves as reported [2]. The superior fiber found in okra helps to stabilize blood sugar as it curbs the rate at which sugar is absorbed from the intestinal tract. Okra's mucilage not only binds cholesterol but bile acid carrying toxins dumped into it by the filtering liver

Figure 1. Flowers of Okra (*Abelmochus esculentus*)

Figure 2. Okra Pod and plant

Irritating hairs are sometimes present on the leaves and stems and traces of alkaloid have been reported in leaves. Leaves and fruit have been used as a medicine for relieving moisturize skin, prevent scurvy, induce seating, treating urinary disorders in many countries. Okra mucilage has been used as a plasma replacement and blood volume expander. Okra bark

yields silky fibre which is used to make rope and making papers and cardboards. Okra leaves and seed cake are used as cattle feed

The nutritional quality and potential health benefits of edible parts of okra is reported in the review papers [3, 4]. Further a review on *Abelmoschus esculentus* by Identification and quantification of polyphenolic compounds from okra seeds and skins were reported [5, 6]. A study on some physico-chemical properties of Turkey okra (*Hibiscus esculentus*) seeds [7] and nutrients, antinutrients, minerals and zinc bioavailability of okra was reported [8]. Functional properties of okra has been reported [9] and antioxidant properties [10, 11]. Some physicochemical properties of okra gum has been reported [12]. Nutritional, antinutritional and phytochemical status of okra leave's (*Abelmochus esculentus*) subjected to different processes where significant amount of calcium, magnesium and potassium were found as given below [13]

Table 1. Concentration of elements in leaf of *Abelmochus esculentus* under different conditions.

Parameters evaluated	Lyophilized leaf	Fresh leaf	Bleached leaf	Cooked leaf
Moisture (%)	9.13±0.19^{c}	74.83±1.17^{b}	73.31±0.38^{b}	81.53±0.11^{a}
Lipids (%)	2.00 ±0^{a}	0.93±0.18^{b}	1.00±0.16^{b}	1.07±0.18^{b}
Protein (%)	23.62±0.23^{a}	6.10±0.61^{b}	6.22±0.23^{b}	6.06±0.39^{b}
Ashes (%)	15.39±0.08^{a}	2.75±0.44^{b}	2.84±0.84^{b}	2.49±0.40^{b}
Calcium (mg/100 g)	691±0.22^{a}	382.50±0.71^{b}	357±0.43^{c}	366.50±0.42^{d}
Magnesium (mg/100 g)	438±0.64^{a}	232.50±0.31^{b}	237.50±0.18^{c}	138.50±0.66^{d}
Potassium(mg/100 g)	670.50±0.55^{a}	167.50±0.68^{b}	110.5±0.86^{c}	63±0.91^{d}

Means followed by different letters between columns indicate significant differences with an error probability of $p \leq 5\%$, according to the Tukey's t test.

The present study has been taken to investigate the concentration of different elements in raw pod flesh, unriped seeds and riped seeds of *Abelmochus esculentus*.

2. EXPERIMENTAL

Samples of a green okra fruit and a fully matured dried okra were collected from the same plant. The flesh and the seeds were separated carefully using plastic knife from both samples. Small pieces were made of the pod flesh. A quantity of 5.0 g of each sample was kept in separate crucibles and then placed in the oven to get fully dried at a temperature of 100 °C. The timing required for flesh was required about 60 minutes and for fresh seeds about 40 minutes. The dried seeds just needed about 20 minutes. These samples were made in the powder form using mortar and pestle. 2.0 g of each sample was collected in different conical flasks and then added 50 ml of aqua regia in each conical flask. The samples needed to warm for 30 minutes on the hot plate on a mild temperature to get a clear fully dissolved sample. Further deionized water was added in each conical flask to make a total volume of 100ml. These samples were now ready for records of absorption spectra.

In flame absorption spectroscopy a liquid sample is aspirated and mixed with combustible gases such as acetylene and air or acetylene and nitrous oxide. The mixture was ignited at a suitable temperature of 230 °C.

The atoms of elements of interest in each sample were reduced to the atomic state which is required for such a study. Varian AA 240 series Atomic Absorption Spectrophotometer was used to record the spectra of these samples and a standard procedure was adopted to complete the experiment. Different compatible hallow cathode lamp of the same metal for which the investigation was desired was chosen and intensity was measured which is related to the concentration of the element present after other necessary settings.

3. OBSERVATION

Table 2. Concentration of different elements in *Abelmochus esculentus* in different parts

SAMPLES	PARAMETERS					
	Ca (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Mg (mg/kg)	Mn (mg/kg)
Okra-Raw Pod flesh	8582.85	Nd	10.29	50.97	334.68	9.44
Unriped Okra Seed	1067.23	Nd	13.51	93.78	342.27	21.62
Riped Okra Seed	1816.37	Nd	9.54	64.82	338.58	18.88
SAMPLES	Pb (mg/kg)	Zn (mg/kg)	K (%)	N (%)	P (%)	
Okra-Raw Pod flesh	Nd	45.03	3.62	1.78	0.26	
Unriped Okra Seed	Nd	96.93	2.34	4.32	0.87	
Riped Okra Seed	Nd	77.85	3.56	2.53	0.58	

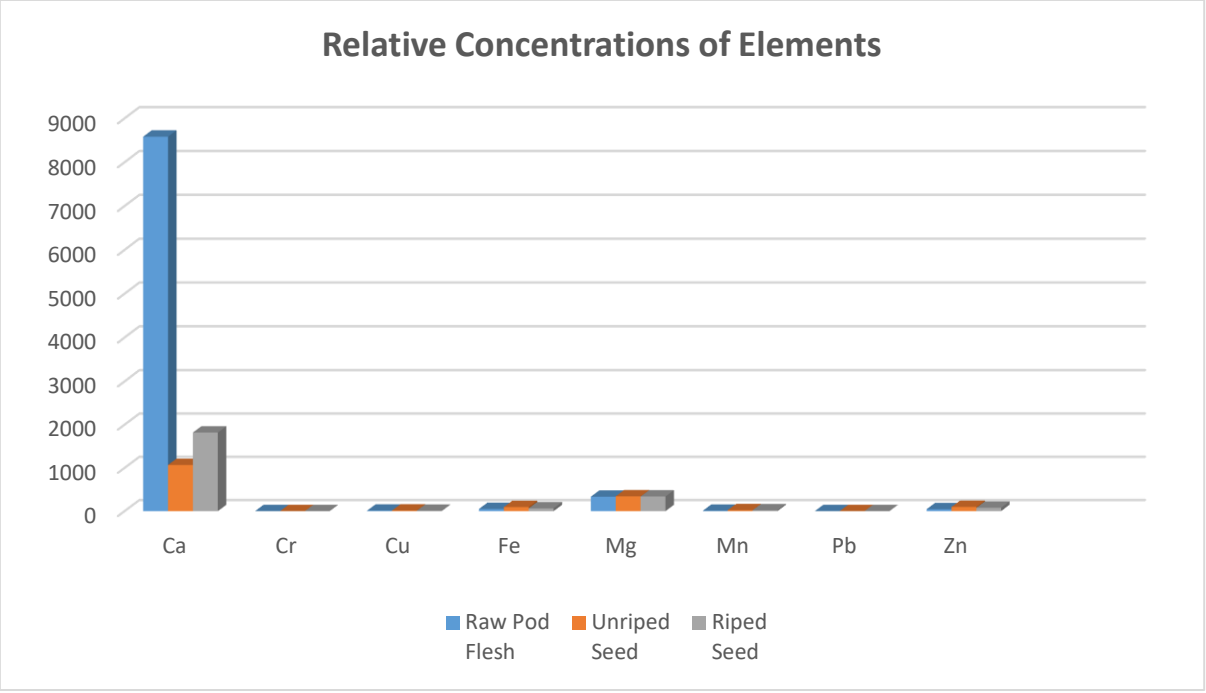

Figure 3. Concentration of elements in raw pod, unriped seed and riped seed of *Abelmochus esculentu*

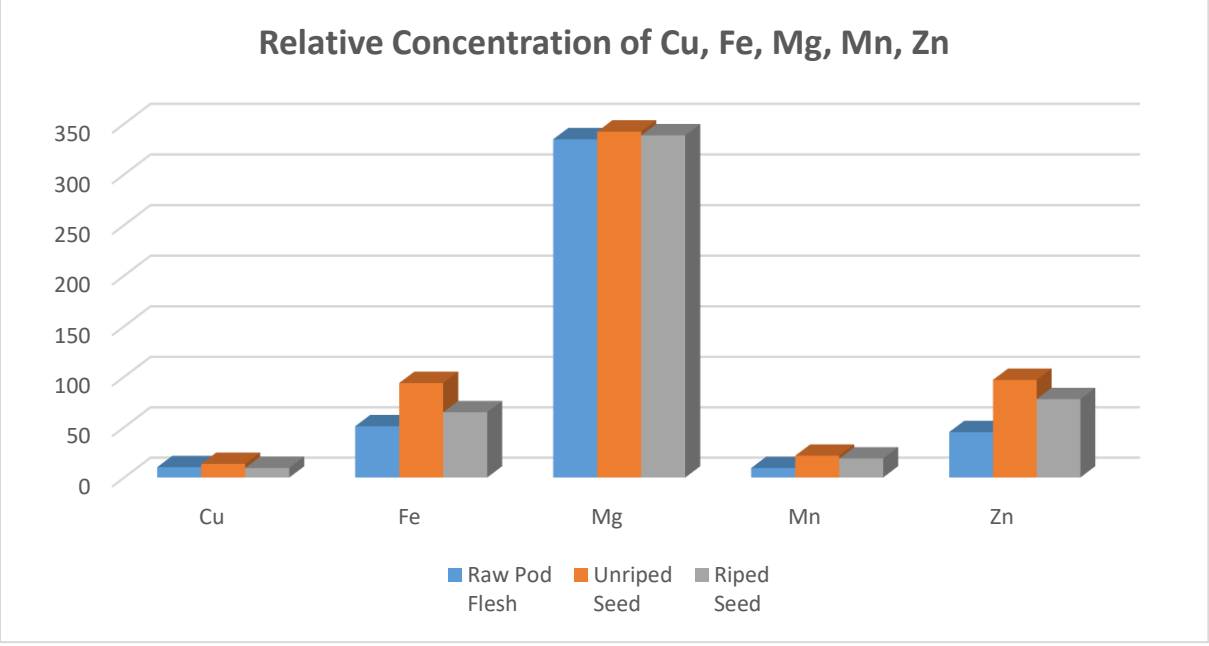

Figure 4. Concentration of elements in raw pod, unriped seed and riped seed of *Abelmochus esculentus*

4. RESULT AND DISCUSSION

A study for combined parts of *Abelmochus esculentus* has been done for the first time. The data show that the presence of calcium is very high in all the parts such as pod flesh, unriped seeds and riped seeds and the highest is observed in the raw pod flesh as 8582.85 mg/Kg where as in one of the earlier study has been reported a very small amount. This variation may be due to number of factors. It is important to note that due to high concentration of calcium in okra can be used medically for a good health and strong bones in body. The other two parts as unriped and riped seeds are also having a sufficient amount of calcium as 1067.23 mg/Kg and 1816.37 mg/Kg respectively. The next high amount is found of the magnesium having the quantities 334.68, 342.27 and 338.58 mg/Kg for raw pod flesh, unriped seeds and riped seeds. Another interesting finding is about non absorbing lead in all parts of okra and thus okra has quality to use safely free from dangerous lead poisoning. In general the unriped seeds showing high quantity than the riped seeds for most of the nutrients in okra.

5. CONCLUSION

Abelmochus esculentum has many nutrients specially a very high concentration of calcium for healthy and strong bones.

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