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## Determination of Potassium Content In Ripe and Raw Plantains And The Impact of Different Cooking Methods on Its Loss - ICP- OES Method

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### ABSTRACT

Objective of this research work was to employ advanced analyzing technique like ICP-OES in evaluating the potassium content of the entire plantain fruit. Often the skin part of the fruit is removed before using it. The analysis revealed that the potassium content of plantain (*Musa paradisiaca*) is much (800 mg/gm) more than it was believed (400 mg/gm) to have. Though the skin part of the fruit constitutes only 10-15 %, almost 50 % of potassium content comprised in the skin. (Around 1500mg/gm Potassium in together with peel and pulp). Effect of different cooking methods of ripe and raw are also evaluated. Heavy Potassium loss, approximately 50 %, observed in boiling and 15-20 % Potassium loss observed in steaming. The findings of this work can be incorporated in formulating a proper diet for patients with hypokalemia and hyperkalemia. Advanced ICP-OES methods for elemental analysis increases the specificity and sensitivity of the results.

**Keywords:** ICP-OES, potassium content, *Musa paradisiaca*, hypokalemia, hyperkalemia

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## INTRODUCTION

Plantain (*Musa paradisiaca*) is a perennial herbaceous plant which are cultivated largely in tropical and subtropical countries. They are abundant in South Indian States and one of the main agricultures there. It has been an important business of common man there. Existence of Plantains is recorded in 5000 year old Indian literature Ramayana. Being the most and accessible medicinal herb in southern India, it differs from bananas. Plantains have thicker skins and longer in size than bananas. The entire plantain is used as a vegetable. Though it contains low carbohydrates, plantains relatively have more calories than that in the fruit bananas.<sup>1,2</sup>

Plantains contain more vitamin A than bananas. As in bananas, they too are rich sources of B-complex vitamins, particularly high in vitamin-B6. They provide adequate levels of essential minerals such as potassium, iron, magnesium, and phosphorous<sup>1</sup>. Fresh plantains have more potassium than bananas, an average banana has been reported to contain 499 mg of potassium/100g and only 1 mg of sodium. A banana a day may help to prevent high blood pressure and protect against atherosclerosis. Potassium is an important component of cell and body fluids that helps to control heart rate and blood pressure, countering negative effects of sodium. Since Plantains are potassium rich vegetable it should be avoided or limited for patients with advanced renal failure or those that are on dialysis<sup>3-5</sup>.

Bananas have long been recognized for their antacid effects that protect against stomach ulcers, heart burns, stress, strokes, pain relief, swelling, itching, bruising, wrinkles, sunburn, gonorrhea and many other ailments. Some of the substances in bananas help to activate the cells of the stomach lining, stimulating cell proliferation which thickens the stomach mucosa and act as barrier against stomach acids while others like protease inhibitors help eliminate bacteria in the stomach that are the primary cause of stomach ulcers<sup>6,7</sup>. Animal studies have shown that banana has the potential to lower cholesterol. It was suggested that the dietary fiber component in banana pulp was responsible for its cholesterol lowering effect. The amount of dietary fiber in banana is relatively constant during banana ripening<sup>8,9</sup>.

Not only the fruit bananas but the stem also recognized for its antacid effects. Banana stem, botanically it is considered as a flower stalk that supports the entire plant, which contains a type of fiber which slows down the process of releasing sugar and fats stored in our body cells in to the blood stream<sup>10</sup>.

Advanced method of analysis helps us to determine the individual nutrient and mineral contents. Plantain can be cooked or otherwise processed and are used either when unripe (therefore less

starchy) or ripe (therefore sweet). These cooking or processing method employed influences the biochemical and nutritional composition of plantain <sup>11</sup>.

The objective of my study was to employ modern analytical methods like ICP-OES to analyze the potassium content of the ripe and raw plantain and its peels and the effect of different cooking process that affect the potassium content.

## MATERIALS AND METHOD

The plantain samples (both raw and ripe) were collected from local market and washed under running tap water. Then the samples were segregated for different cooking procedures such as boiling and steaming. Raw plantains of known weights were boiled and steamed with peel and without peel. Similarly ripe plantains of known weights were steamed and boiled with peel and without peel. Both raw and ripe plantains uncooked with peel and without peel were kept as control samples. Then all samples were dried in a hot air oven at 100<sup>0</sup> C until attains constant weight to remove any moisture content. The samples were powdered and digested for the analysis.

### Digestion:

2g of powdered sample were taken in a glass beaker. To this 3ml conc. Nitric acid was added and heated on a hot plate to digest the organic matter. When the solution is clear, it kept for cooling and 1ml of hydrochloric acid is added. It was heated on a hot plate and then cooled and filtered in to a volumetric flask and made up to the mark with distilled water.

### Method:

Samples were analyzed for potassium content by using ICP-OES. Appropriate dilution was made with respect to the calibration range used. The solutions were introduced in to the ICP by free aspiration. By comparing emission intensities of elements in the test specimen with the prepared standards, the concentrations of potassium was calculated and reported.

## RESULTS AND DISCUSSION

The results were as follows:

### Raw (unripe) Plantain- Uncooked

Samples	With peel (Potassium in mg/kg)	Without peel (Potassium in mg/kg)
Sample I	15374	8412
Sample II	15484	8495
Sample III	15176	8284
Sample IV	15398	8387

**Ripe plantain- Uncooked**

<b>Samples</b>	<b>With peel (Potassium in mg/kg)</b>	<b>Without peel (Potassium in mg/kg)</b>
Sample I	15302	8356
Sample II	15206	8304
Sample III	15084	8195
Sample IV	15214	8290

**Raw (unripe) Plantain- after boiling**

<b>Samples</b>	<b>With peel (Potassium in mg/kg)</b>	<b>Without peel (Potassium in mg/kg)</b>
Sample I	7569	4456
Sample II	7628	4531
Sample III	7594	4482
Sample IV	7402	4365

**Raw (unripe) Plantain- after steaming**

<b>Samples</b>	<b>With peel (Potassium in mg/kg)</b>	<b>Without peel (Potassium in mg/kg)</b>
Sample I	12786	7661
Sample II	12891	7736
Sample III	12594	7514
Sample IV	12764	7464

**Ripe Plantain- after steaming**

<b>Samples</b>	<b>With peel (Potassium in mg/kg)</b>	<b>Without peel (Potassium in mg/kg)</b>
Sample I	12798	7896
Sample II	12785	7753
Sample III	12602	7687
Sample IV	12804	7875

**DISCUSSION**

As per the results, the potassium content in plantains is more than it is believed to have. It is interesting to note that though the skin of plantain occupies 10-15% of its total weight, 50% of total potassium is contributed by its skin. Leaching of raw as well as the ripe plantain showed a significant drop in the potassium content. Steaming of plantain did not result in a significant drop as much as it had during boiling. Boiling reduced the potassium content by 40-50 % while steaming by 15-20%.

**CONCLUSION**

Often the nutritional and mineral values of the skin of fruits and vegetables are neglected. But the analysis shows the importance of the investigation not only for the pulp but for its skin too. Also the loss of nutritional and mineral values by different cooking method are also relevant to calculate the diet of potassium deficient as well as renal compromised patients.

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