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ESTIMATIONTHE NUTRITIONAL ELEMENTS PRESENT IN NATURALLY RIPENED AND ARTIFICIALLY RIPENED BANANAS.

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RESEARCH ARTICLE

ABSTRACT[1]:

The aim of this work is to compare quantitatively the nutritional elements present in naturally ripened and artificially ripened bananas. Comparative study is done to evaluate the effect of calcium carbide as an artificial ripening agent on shelf life, physio -chemical properties, iron containment and quality of Musa paradisiacal .L.,and to bring awareness among the people to consume naturally ripened bananas than consuming artificially ripened bananas. Estimation of nutritional elements in naturally ripened and artificially ripened bananas is done by established methods. The results obtained by performing the above methods concluded that nutritional elements are high in naturally ripened bananas than artificially ripened bananas excluding heavy metal contents, as these are high in artificially ripened bananas than naturally ripened bananas.

INTRODUCTION:

Bananas are ripened naturally and artificially .naturally bananas are ripened by natural methods and artificially bananas are ripened by spraying artificial agents like calcium carbide, ethanol, methanol, ethylene glycol, Ethiopian. Mechanism of naturally ripened bananas : Unripe fruits often contain various types of organic acids, namely citric acid, malic acid, ascorbic acid, formic acid, tartaric acid etc . These acids are held responsible for the sour taste of fruits. After certain chemical changes these acids are transformed into sugars and the fruits turn sweet. In fruit ripening process, Chlorophyll is produced and at the same time decomposed. Starch is induced by Amylase usually produces sugar. Pectin converts into pectinase and decomposition of pectin, in this

case unglues the fruit cells. The cells being able to slip past one another makes the fruit further soft. Ethylene is the major ripening agent produced naturally within the fruits which initiates the process of ripening[1].

Mechanism of artificially ripened bananas: Calcium Carbide is widely used in different parts of the world. Once applied on the fruits Calcium Carbide comes into the contact of the moisture and releases acetylene, which has fruit ripening characteristics similar to ethylene. Industrial grade calcium carbide contains traces of arsenic and phosphorus hydride, which are hazardous for human health in direct contact[2].

$$CaC_2 + 2H_2O = Ca(OH)_2 + C_2H_2$$

The pharmacognostic profile of banana: Scientific name: Musa Paradissiaca.L ,Botanical family: Musaceae. Bananas are elliptically shaped fruits "prepackaged" by Nature, featuring a firm, creamy flesh gift-wrapped inside a thick inedible peel. Bananas abound in hundreds of edible varieties that fall under two distinct species: the sweet banana (Musa sapienta, Musa nana) and the plantain banana (Musa Paradissiaca.L). Sweet bananas vary in size and color. While we are accustomed to thinking of sweet bananas as having yellow skins, they can also feature red, pink, purple and black tones when ripe. Their flavor and texture range with some varieties being sweet while others have starchier characteristics[3].

The nutritional profile of banana includes carbohydrates, sugar, soluble and insoluble fiber, sodium, vitamins, minerals, fatty acids, amino acids and more. The **banana** contains plenty of water and carbohydrates. About 1% consists of fiber, protein and fat. The whole plant is rich in tannins, phenolics, biogenic amines and nucleosides[5].

Some of the disadvantages of calcium carbide-their consumption can cause serious health problems, such as heart disease, skin disease, lung failure and kidney failure. Scientists have also reported that regular consumption of artificial ripened fruits may cause dizziness, weakness, skin ulcer and heart related diseases. Calcium carbide is alkaline in nature and irritates the mucosal tissue in the abdominal region. Calcium carbide has cancer-causing properties and causing neurological disorders. It can result in tingling sensation and peripheral neuropathy. A significant number of pregnant women consumed fruit ripened with carbide, the children born with abnormalities. Acetylene, generated from carbide reduces oxygen supply to the brain, In acute stage, it causes headache, vertigo, dizziness, delirium, seizure and even coma. In the long term, it may produce mood disturbance and loss of memory. Other toxic effects include skin burn, allergy, jaundice and carcinogenic potential. Calcium carbide may cause severe eye irritation with possible burns. Eye contact may result in permanent eye damage or blindness. It may cause stinging pain, severe burns, watering of eyes, inflammation of eyelids and conjunctivitis, opacity and scarring. Calcium carbide causes Mouth, nose, throat and lung irritation with coughing and severe shortness of breath (pulmonary edema), rapid irregular breathing, headache and burns to mucous membranes. May cause severe irritation of the upper respiratory tract with pain, burns, inflammation and can produce delayed pulmonary edema. Repeated inhalation may cause chronic bronchitis[6].

EXPERIMENTAL DETAILS:

MATERIALS AND INSTRUMENTS:

***Instruments used*:** Furnace: Total ash content determination**,** Hot air oven: Moisture content and fiber content determination**,**Soxhlet apparatus: Fat content determination**,**UV-VISIBLE spectrophotometer: Total iron, ferrous and ferric content determination; Copper content and Manganese content determination.

***Materials used*:** Distilled water,Na-EDTA,Sulfuric acid (0.1N),Nitric acid (0.1N),Hydrochloric acid (0.1N),Diethyl ether,Erichrome black t indicator,1,10 phenanthroline indicator,Xylenol

orange indicator,Pattons and readers reagent,Folin-catechu reagent, Sodium acetate, Hydroxyl amine hydrochloride, Ammonia ammonium chloride buffer, Ammonia solution, Potassium periodate,Phosphoric acid, Potassium thiocyanate,Potassium hydroxide ,Sodium carbonate.

METHODOLOGY:

PRE-TREATMENT OF SAMPLES:

The skin (body) of selective Fruits was washed gently with distilled water then cleaned properly with cotton cloth to remove dust, adhered particles and agricultural chemicals then stored in a cool and dry place[11].

SOAKING OF SAMPLES:

Accurately weighed and cleaned, chopped fruit (chopped flesh form) were soaked in 60mL of distilled water, similarly 0.1M HCL, 0.1M H_2SO_4 and 0.1M HNO_3 were used for different time intervals (2 and 4 Hrs.) at room temperature 32±2°c . After different time intervals the sample was filtered in a 100mL volumetric flask and then made up the volume with their respective solutions. These samples were labeled and stored in cool and dry place; these samples were used for different techniques such as Visible Spectrophotometry, and Complexometry[11].

DIGESTION OF SAMPLES:

On complete ignition of organic matter, metal oxides were obtained as ashes. In a neat and clean weight china dish, 5g fruit's flesh was taken and then 30mL of concentrated acid ($HCL/H_2SO_4/HNO_3$) was poured and then heated on a hot plate until complete dryness. This material was transferred in weighed crucible and heated in furnace first at 550°c and then at 900 °c. This ash was transferred in 100mL flask and then made up with 0.1M respective acid ($HCL/H_2SO_4/HNO_3$). Another ash was prepared just by heating weighed amount of fruit's flesh at hot plate (without adding any acid) at 550 °c and at 900 °c, this sample was given the name "Simple Ash"[12].

DETERMINATION OF TOTAL IRON:

The determination method for total iron (Fe+3, Fe+2) was 1,10-phenanthroline method. Only Fe+2 ions could be analyzed at 509nm, there was no any interfering effect of making the exact determination of Fe+2 in the complex environment of the fruit. Sodium acetate was used to adjust pH, and to convert ferric into ferrous ,hydroxylamine hydrochloride was used. For this purpose 10mL of sample + 2mL hydroxyl amine hydrochloride + saturated solution of sodium acetates to maintain pH 3.5 + 2mL of OPT was taken in 50mL volumetric flask and solution was made up with distilled water. The absorbance was measured at 509nm. Similarly blank solution was prepared except adding sample. Care was taken to scan the sample under maximum 45min. Otherwise the coloration would be changed and leads to erroneous result[12].

DETERMINATION OF Fe^{+3} :

The determination method for total iron (Fe+3, Fe+2) was 1,10-phenanthroline method. Total iron (Fe+3, Fe+2) could be analyzed at 509nm. Sodium acetate was used to adjust pH. For this purpose 10mL of sample + saturated solution of sodium acetates to maintain pH 3.5 + 2mL of OPT was taken in 50mL volumetric flask and solution was made up with distilled water. The absorbance was measured at 509nm. Similarly blank solution was prepared except adding sample. Care was taken to scan the sample under maximum 45min. Otherwise the coloration would be changed and leads to erroneous result. To determine Fe^{+3}content ,we should subtract the value of Fe^{+2} content from the value of total iron content[12].

ASH CONTENT DETERMINATION :

The ash content was determined using the following method,5g of the sample was weighed

into a crucible in a muffle furnace and heated at 550 °c for six hours until it became gray ash. The dish was removed from the muffle furnace using crucible tong and placed in a desiccator to cool. When cooled it was re-weighed and the weight of ash was obtained by the difference[13].

MOISTURE CONTENT DETERMINATION:

The moisture content of the samples was determined using the following method ,The Petri-dish was washed thoroughly and placed in oven to dry. 5g of the sample was then placed in a pre weighed Petri dish, and then placed in an oven to dry at 105°c for two hours. The dish and dry sample were transferred to a desiccator to cool at room temperature before being weighed again. The experiments were repeated until constant weight was obtained[9].

FAT CONTENT DETERMINATION:

Fat was determined using soxhlet fat extraction method . 250ml boiling flask was washed thoroughly and dried in oven at 105°c for 30 minutes and then placed in a desiccator to cool. 2g of the dried sample was then weighed accurately into labeled thimbles. Cooled boiling flask was filled with 200ml of petroleum ether and boiled at 40-60°c .The extraction thimble was plugged lightly with a cotton wool and the boiling flask containing the petroleum ether was placed in the extraction thimble to boil and the soxhlet apparatus was allowed to reflux for six hours. The thimble was removed carefully, and the petroleum ether on top of the container was collected and drained into another container for reuse. When the flask was free of petroleum ether, it was removed and boiled for an hour at 105°c. It was finally transferred from the oven into a desiccator to cool before weighing[9].

FIBRE CONTENT DETERMINATION :

Crude Fiber content was determined by Weende's method. 2g of the sample was weighed into a 250ml conical flask and 200ml of 1.25% $H_2SO_4$was added and the mixture was boiled under reflux for 30minutes. The solution was filtered with whattmann filter paper; the residue was rinsed thoroughly with hot water until it was no more acidic when tested using pH paper. The residue was transferred into a 250ml beaker and 200ml of 1.25% NaOH was added and boiled for 30minutes in a digestion apparatus after which it was filtered and rinsed with distilled water until the filtrate was neutral when tested with pH paper. The residue was transferred into a crucible and placed in electric oven at 100oC for eight hours to dry. It was then removed and placed in a desiccator to cool before weighing. After weighing, the sample was incinerated, cooled in a desiccator and reweighed[9].

PROTEIN DETERMINATION:

Delivered aliquots of standard drug solution (50µg/ml)in to a series of 25ml calibrated tubes and the volume were adjusted to 5ml with distilled water. To each of the test tubes 5ml of Na_2CO_3 and 1.5ml of F.C. reagent were added and kept aside for 5mins. The volume was brought to the mark with distilled water. The absorbance was measured after 15mins at 620nm against a reagent blank prepared under identical conditions. The amount of the drug was computed from the appropriate calibration graph[9].

CARBOHYDRATE DETERMINATION :

The carbohydrate content of the test sample was determined by estimation using the arithmetic difference method [9].

(%CHO = 100 – (% fat. + % ash + % fibe

HEAVY METAL ANALYSIS :

The heavy metals content of Musa Paradissiaca.L was determined using EDTA titrimetric method . All determinations were done in duplicates and values of heavy metals were reported in Mg/L.

DETERMINATION OF ZINC:

This was determined by EDTA titrimetric method . 2ml of sample solution was measured into a conical flask and 2ml of buffer solution was added to it. Then, 2 drops of Eriochrome Black T Indicator was added and the mixture titrated with 0.01 EDTA until the color changed from wine red to blue[10].

DETERMINATION OF LEAD:

The Lead content in the sample was determined using spectrophotometric method . 10ml of the sample solution was measured into a beaker, followed by addition of 5 drops of 10% KCN, 5ml of 1.2M NH3 solution and 5ml of 10% NaSO4. The resulting mixture was made up to the 50ml with distilled water. The spectrophotometer was set at wavelength of 430nm after calibration and the absorbance reading of the sample solution taken[10].

DETERMINATION OF COPPER:

To determine the copper content, 10ml of the digested sample was measured into 50ml of volumetric flask. 10ml of 0.01N NH4OH was added to the solution and the resultant mixture made up to 50ml using distilled water. It was allowed to develop for 30mins, before absorbance reading was taking with aid of the spectrophotometer at wavelength of 620nm[10] .

DETERMINATION OF MANGANESE:

Manganese content was determined by using the spectrophotometer. 20ml of the digested sample was measured into 50ml volumetric flask, then 5ml of phosphorus and 0.3g of potassium per iodate were added and the mixture shaked before boiling for 15mins. It was allowed to cool before diluting with distilled water to make up to the 50m mark on the standard flask. The resultant solution was then allowed to develop for 30mins. The absorbance of the solution was read using the spectrometer machine at wavelength of 520nm[10] .

DETERMINATION OF CADMIUM:

Cadmium determination was carried out by EDTA titrimetric method using Xylenol Orange as an indicator. 25ml of the sample was measured into a 250ml conical flask. Then 5ml of distilled water, 3 drops of xylenol orange indicator and 1 drop of dilute H2SO4 were added to the sample solution. Thereafter, the color Proximate Nutritional Analysis And Heavy Metal Composition Of Musa paradisiacaL.turned to yellow and hexamine powder was added until the color changed to deep red. It was then titrated with 0.05m EDTA until color change from deep red to initial yellow was observed[10].

DETERMINATION OF CALCIUM:

This was determined by ethylenediaminetetraaetic acid (EDTA) titrirmetric method . 10ml of the digested sample was measured into a 250ml conical flask. A pinch of potassium cyanide, a pinch of hydroxylamine hydrochloride, 5ml of 10% potassium hydroxide were added and shaken gently until the solids dissolve. Then a pinch of indicator (Pattons & Reader's reagent) was added and the mixture titrated with the 0.01M EDTA solution until the color changed from wine red to blue which is the end point[10].

DETERMINATION OF MAGNESIUM:

Magnesium was determined using EDTA titrirmetric method . 10ml of the digested sample was pipetted into 250ml conical flask, a pinch of KCN, a pinch of hydroxyl ammonium chloride solution and 5ml of 10% potassium hydroxide were added and shaken gently until the solid dissolved. A pinch of Eriochrome black T indicator was added and the mixture was titrated with 0.01M EDTA solution until the wine red color changes to blue color which is the end point[10].

RESULTS AND DISCUSSION:

1) Moisture content:

The values were taken for both natural and artificial bananas and substituted in this formula to get moisture content values.

Moisture content = Initial weight-Final weight

The moisture content value for naturally ripened bananas is 3.75g and the moisture content value for artificially ripened bananas is 3.54g. A statistical difference in moisture content was observed between a naturally ripened banana and artificially ripened banana and it was validated by calculating the standard deviation, so naturally ripened bananas may have more shelf life when compared to artificially ripened bananas.

2) Fat content:

The values were taken for both natural and artificial bananas and substituted in this formula to get fat content values.

Fat content = Initial weight-Final weight

The fat content value for naturally ripened bananas is 0.93g and the fat content value for artificially ripened bananas is 0.8g. A statistical difference in fat content was observed between a naturally ripened banana and artificially ripened banana and it was validated by calculating the standard deviation.

3) Fiber content:

The values were taken for both natural and artificial bananas and substituted in this formula to get fiber content values.

Fiber content = Initial weight-Final weight

The fiber content value for naturally ripened bananas is 0.39g.The fiber content value for artificially ripened bananas is 0.30g.A statistical difference in fiber content was observed between naturally ripened and artificially ripened banana and it was validated by determining standard deviation, so by this ,consumption of naturally ripened banana provides more amount of fiber which is necessary for healthy benefits of a person.

4) Ferrous content:

The required quantities of soaked samples were taken and dissolved in suitable required solvents ($HCL/H_2SO_4/HNO_3$, DISTILLED WATR)and made up with the required contents to develop the color according to the given procedures.

After the color was developed then the values were estimated spectroscopically and found that ferrous was more solubilised in HNO_3 and those values were considered. The amount of ferrous present in naturally ripened bananas is 0.27mg.The amount of ferrous present in artificially ripened bananas is 0.17mg.A statistical difference in ferrous content was observed in naturally ripened and artificially ripened banana and it was validated by determining standard deviation, so it was observed that naturally ripened banana have more antioxidant property when compared to artificially ripened banana, because ferrous has an antioxidant property.

5) Copper content:

The required quantities of soaked samples were taken and dissolved in suitable required solvents ($HCL/H_2SO_4/HNO_3$,DISTILLED WATR)and made up with the required contents to develop the color according to the given procedures.

After the color was developed then the values were estimated spectroscopically and found that copper was more solubilised in H_2SO_4 and the corresponding values were considered.

A statistical difference in copper content was observed in naturally ripened and artificially ripened banana and it was validated by calculating standard deviation.

6) Manganese content :

The required quantities of soaked samples were taken and dissolved in suitable required solvents ($HCL/H_2SO_4/HNO_3$,DISTILLED WATER) and

made up with the required contents to develop the color according to the given procedures.

After the color was developed then the values were estimated spectroscopically and found that manganese was more solubilised in HCL and the corresponding values were considered.

A statistical difference in copper content was observed in naturally ripened and artificially ripened banana and it was validated by calculating standard deviation.

7) Ferric content :

The required quantities of soaked samples were taken and dissolved in suitable required solvents ($HCL/H_2SO_4/HNO_3$,DISTILLED WATER)and made up with the required contents to develop the color according to the given procedures.

After the color was developed then the values were estimated spectroscopically and found that ferric was more solubilised in H_2SO_4 and the corresponding values were considered.

The amount of ferric content present in naturally ripened bananas is 35mg.The amount of ferric content present in naturally ripened bananas is 22mg. A statistical difference in ferrous content was observed in naturally ripened and artificially ripened banana and it was validated by determining standard deviation, so it was observed that naturally ripened banana have more antioxidant property when compared to artificially ripened banana, because ferrous has an antioxidant property.

8) Cadmium content:

The required quantities of soaked samples were taken and dissolved in suitable required solvents ($HCL/H_2SO_4/HNO_3$,DISTILLED WATER)and made up with the required contents according to the given procedures.

After the color was developed then the values were estimated titrimetrically and found that cadmium was more solubilised in HNO_3 and the corresponding values were considered.

The amount of cadmium present in naturally ripened bananas is 0.0013g.The amount of cadmium present in naturally ripened bananas is 0.0019g.A statistical difference in cadmium content was observed between naturally ripened and artificially ripened banana and it was validated by calculating standard deviation and it was predicted that consumption of artificially ripened banana provides heavy metal cadmium which is considered to be toxic to human beings.

9) Zinc content:

The required quantities of soaked samples were taken and dissolved in suitable required solvents ($HCL/H_2SO_4/HNO_3$, DISTILLED WATER)and made up with the required contents according to the given procedures.

After the color was developed then the values were estimated titrimetrically and found that zinc was more solubilised in Distilled water and the corresponding values were considered.

The amount of zinc present in naturally ripened bananas is 0.004g.The amount of zinc present in naturally ripened bananas is 0.013g. A statistical difference in cadmium content was observed between naturally ripened and artificially ripened banana and it was validated by calculating standard deviation, and it was predicted that consumption of artificially ripened banana provides heavy metal zinc which is considered to be toxic to human beings.

10) Total ash content:

The amount of ash present in naturally ripened bananas is 0.06g.The amount of ash present in naturally ripened bananas is 0.05g.A statistical difference in ash content was observed between naturally ripened and artificially ripened banana and it was validated by calculating standard deviation and it was observed that ash content is

more in naturally ripened banana than artificially ripened banana.

11) Calcium content:

The required quantities of soaked samples were taken and dissolved in suitable required solvents ($HCL/H_2SO_4/HNO_3$, DISTILLED WATER)and made up with the required contents according to the given procedures.

After the color was developed then the values were estimated titrimetrically and found that calcium was more solubilised in Distilled water and the corresponding values were considered.

The amount of calcium present in naturally ripened bananas is 0.163g.The amount of calcium present in artificially ripened bananas is 0.143g. A statistical difference in calcium content was observed between naturally ripened and artificially ripened banana and it was validated by calculating standard deviation, and it was predicted that consumption of naturally ripened banana provides high intake of calcium than artificially ripened banana which is necessary for healthy benefits of human beings.

12) Protein content:

By taking samples in different solvents, standard graphs are plotted by taking mixture of amino acids namely tryptophan, phenyl alanine and cystiene. From the standard graphs we obtain the quantity of proteins present in the sample.

The amount of protein present in naturally ripened bananas is 5.25mg.The amount of protein present in naturally ripened bananas is 1.5mgA statistical difference in protein content was observed between naturally ripened and artificially ripened banana and it was validated by calculating standard deviation, and it was predicted that consumption of naturally ripened banana provides high intake of protein than artificially ripened banana which is necessary for healthy benefits of human beings.

SUMMARY AND CONCLUSION:

The main scope and aim of the present work is the nutritional estimation between naturally and artificially ripened bananas. So by following the above methods given in methodology we came to a conclusion that there is a decrease in the nutritive values and increase in heavy metal contents among the artificially ripened bananas when compared to naturally ripened bananas. Thus the consumption of artificially ripened bananas may be dangerous to health.

- The total ash content was found to be more in naturally ripened bananas when compared to artificially ripened bananas.
- The fat content was found to be more in naturally ripened bananas when compared to artificially ripened bananas.
- The moisture content was found to be more in naturally ripened bananas when compared to artificially ripened bananas.
- The fiber content was found to be more in naturally ripened bananas when compared to artificially ripened bananas.
- The ferrous content was found to be more in naturally ripened bananas when compared to artificially ripened bananas.
- The ferric content was found to be more in naturally ripened bananas when compared to artificially ripened bananas.
- The total ash content was found to be more in naturally ripened bananas when compared to artificially ripened bananas.
- The total ash content was found to be more in naturally ripened bananas when compared to artificially ripened bananas.
- The shelf life was found to be more in naturally ripened bananas when compared to artificially ripened bananas.
- The calcium content was found to be more in naturally ripened bananas when compared to artificially ripened bananas.
- The carbohydrate content was found to be less in naturally ripened bananas when compared to artificially ripened bananas.

- The zinc content was found to be less in naturally ripened bananas when compared to artificially ripened bananas.
- The cadmium content was found to be less in naturally ripened bananas when compared to artificially ripened bananas.

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S.NO	NUTRITIVE ELEMENTS	NATURALLY RIPENED	ARTIFICIALLY RIPENED
1.	Ash content	1.2%	1%
2.	Carbohydrates	33.2%	43.4%
3.	Fat content	46.5%	41.0%
4.	Fiber content	19%	14.5%
5.	Ferrous content	0.0075%	0.0047%
6.	Ferric content	0.972%	0.611%
7.	Protein content	0.008%	0.002%
8.	Moisture content	75%	71%
9.	Shelf life	7 days	5 days
	INORGANIC METALS		
10.	Zinc	0.004g	0.013g
11.	Calcium	0.163g	0.143g
12.	Cadmium	0.0013g	0.0019g