Quantitative Analysis of Oxalate content and Nutritive study of common Vegetables in Rural Market

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Abstract

The oxalate content of different vegetables such Brassica oleracea (Cauliflower), Lycopersicon esculentum (tomato), Abelmoschus esculentus (Ladies Finger), Cucumis sativus (Cucumber), Brassica oleracea (Cabbage), Solanum melongena (Brinjal) Solanum tuberosum (potato) were determined permagnometrically in order to know which vegetable would supply more oxalate to our body. Oxalates are organic acids that occur naturally in plants, animals and humans. Determination of oxalate content by redox titration is an easy, safe and fast method. Potassium permanganate is a powerful oxidising agent in acid medium and can oxidise reducing agents like oxalate. This would help in determining the amount of oxalate content in various vegetables. The oxalate ion concentration were found to be 52.8mg/50g for Brassica oleracea var. botrytis *(Cauliflower), 61.6mg/50g for* Lycopersicon esculentum *(tomato), 93.72mg/50g for* Abelmoschus esculentus *(Ladies Finger), 105.6mg/50g for* Cucumis sativus *(Cucumber), 111.32mg/50g for* Brassica oleracea var. capitata *(Cabbage), 181.28mg/50g for* Solanum melongena *(Brinjal) and 216.9mg/50g for* Solanum tuberosum *(potato). Our analysis proved that selected samples were rich in carbohydrates, starch, iron, potassium and magnesium.*

Keywords: oxalate content, organic acids, redox titration

Introduction

Oxalate are organic acids that occur naturally in plants, animals, and humans, It is not an essential molecule and is excreted from our body, unchanged. Our body either produces oxalate ion on its own or converts other molecules to oxalate. Oxalate occurs in many plants, where it is synthesized by the incomplete oxidation of carbohydrates. Oxalic acid irritates the lining of the gut when consumed, and can prove fatal in large doses[1-5]. Healthy individuals can safely consume such vegetables in moderation, but those with kidney disorders, gout, rheumatoid arthritis or certain forms of chronic vulvar pain are typically advised to avoid foods high in oxalate.

Oxalate can become problematic, however, if they over accumulate inside our body. The key site for problems with over accumulation is our kidneys. It is being recommended to limit the intake of oxalate-rich foods, specifically for individuals at risk for kidney stone formation[6-9]. The oxalate content of food can vary considerably between plants of different vegetables due to difference in climate and soil quality. The content of oxalate ion present in a specific fruit or a vegetable can be determined by a carrying out experiment on the crushed pulp of that vegetable. The experiment gives the strength of oxalate ion content which can be directly related to the amount of oxalate ion present in that specific fruit or vegetable. For our present study we selected some common vegetables from our locality like Brassica oleracea var.botrytis (Cauliflower), Lycopersicon esculentum (tomato), Abelmoschus esculentus (Ladies Finger), Cucumis sativus (Cucumber), Brassica oleracea var. capitate (Cabbage), Solanum melongena (Brinjal) and Solanum tuberosum (potato) to

find out the most suitable variety (that contain low oxalate content) so that it could be referred to the people who were suffering from kidney stone.

Material and Methods

Sample collection and preparation

Vegetables such as Brassica oleracea (Cauliflower), Lycopersicon esculentum (tomato), Abelmoschus esculentus (Ladies Finger), Cucumis sativus (Cucumber), Brassica oleracea (Cabbage), Solanum melongena (Brinjal) and Solanum tuberosum (potato) were collected from a local market. The selected vegetables were then washed thoroughly with water. The vegetables are then weighed separately in an electronic balance and crushed to fine paste using pestle-mortar.

Weigh 50 g of fresh vegetable pulp and crush it to a fine pulp using pestle and mortar. Transfer the crushed pulp to a beaker and add about 50 ml dil. H_2SO_4 to it. Boil the content for 20 minutes. Cool and filter the contents in a 100 ml measuring flask. Make the volume up to 100 ml by adding distilled water.

Estimation of free oxalate ion present in vegetable samples

Take 20 ml of vegetable sample solution from the measuring flask into a titration flask and add 20 ml of dil. H_2SO_4 to it. Heat the mixture to about 60^oC and titrate it against standardized $KMnO_4$ solution taken in a burette. The end point is appearance of permanent pale pink colour. Repeat the above procedure for all samples.

Qualitative parameters of vegetables

Test for Starch

Take 2 ml of clear fruit juice and add a few drops of Iodine solution. Formation of blue complex indicates the presence of starch.

Test for Carbohydrate

Molisch's test: To the sample taken, 2 drops of 1% alcoholic 1-naphthol solution was added. Add about 1 ml of conc. H_2SO_4 carefully along the sides of the test tube. A violet ring at the junction of the two layer shows the presence of carbohydrate.

Benedict's test: To a little of the sample taken in a test tube, add a few drops of Benedict's reagent. The test tube was heated in a water bath for a few minutes. Appearance of rust brown colour indicates the presence of reducing sugar.

Fehling's Test: To a little of the sample taken in a test tube, add 1 ml of Fehling's solution and heat. Presence of red precipitate indicate the presence of reducing sugar.

Test for Protein

Ninhydrin Test: To a little of sample taken, add 2 ml of ninhydrin solution and heat. Presence of blue colour indicates the presence of protein

Xanthoprotic test: To a little of sample taken add a few drops of conc. HNO_3. Formation of yellow color indicates the presence of proteins**.**

Test for Flavanoids

Alkaline reagent test - Extracts were treated with few drops of NaOH solution. Formation of intense yellow color, which become colorless on addition of dilute acid indicates the presence of flavonoids.

Test for Iron

A drop of test solution is mixed with one small crystal of tartaric acid and a drop of dimethyl glyoxime followed by drops of ammonium hydroxide. Formation of red colour indicated presence of iron.

Test for Potassium

To a little of sample taken in a test tube, add picric acid. Presence of yellow precipitate indicated the presence of K^+ ions.

Test for Calcium

To a little of sample taken, Ammonium chloride and Ammonium hydroxide solutions were added. Filter the solution and to the filtrate 2 ml of Ammonium oxalate solution were added. White precipitate indicated presence of calcium.

Two drops of sample solution was acidified with acetic acid and three drops of saturated solution of Picrolinic acid in water were added. Presence of white crystals indicated presence of calcium.

Test for Magnesium

To about 2 ml of juice excess of Ammonium hydroxide solution and Ammonium chloride solutions were added followed by an excess of disodium hydrogen phosphate solution and shake well, scratch the sides of the test tube with a glass rod. Presence of white precipitate indicated the presence of Magnesium.

A little of sample was treated with few drops of Magneson reagent followed by excess of NaOH solution. Blue precipitate indicated the presences of magnesium.

Results and Discussion

From our investigations, we found that the amount of oxalate ion concentration was high in potato compared to others. Low concentration of oxalate ion was found in cauliflower which was a leafy vegetable. A moderate amount was found in ladies finger, cucumber, and cabbage.

No.	Name of vegetable	Amount of oxalate content/50g
1	Brassica oleracea var. botrytis Cauliflower)	52.8mg
2	Lycopersicon esculentum (Tomato)	61.6mg
3	Abelmoschus esculentus (Ladies Finger)	93.72mg
4	Cucumis sativus (Cucumber)	105.6mg
5	Brassica oleracea var.capitata (Cabbage)	111.32mg
6	Solanum melongena (Brinjal)	181.28mg
7	Solanum tuberosum (Potato)	216.9mg

Table 1: Total Oxalate content in vegetable sample

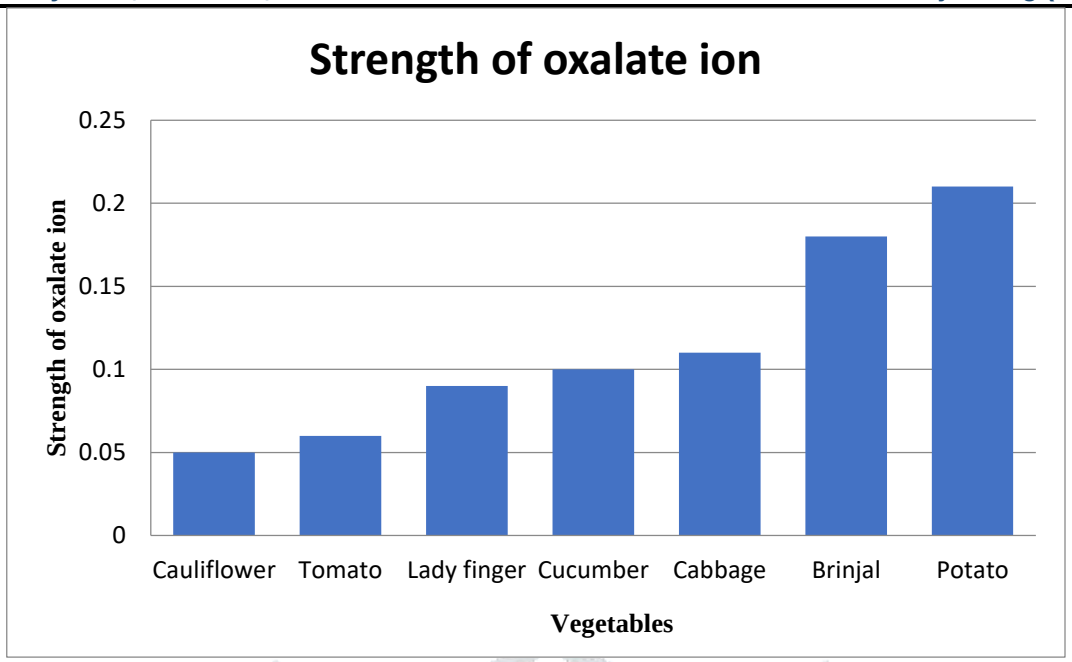

Fig 1: Oxalate ion concentration (mg/50g)

Table 2: Nutritive Analysis

Vegetables	Proteins	Flavanoids	Carbohydrates	Starch	Iron	Ca	K	Mg
Solanum melongena (Brinjal)	✓	✓	✓	✓	✓	×	✓	✓
Lycopersicon esculentum (Tomato)	×	×	✓	✓	✓	×	×	✓
Cucumis sativus (Cucumber)	×	×	✓	✓	✓	×	✓	✓
Abelmoschus esculentus (Ladies Finger)	✓	✓	✓	✓	✓	×	✓	✓
Solanum tuberosum (Potato)	✓	✓	✓	✓	✓	×	✓	✓
Brassica oleracea var. capitata (Cabbage)	×	×	✓	✓	✓	×	✓	✓
Brassica oleracea var. botrytis (Cauliflower)	✓	✓	✓	✓	✓	×	✓	✓

Our nutritive analysis on the selected vegetable samples showed the following results.Proteins and flavonoids were present in all our samples except tomato, cucumber and cabbage. Carbohydrates, starch, iron and magnesium were present in all our selected samples. Potasium was present in all samples except tomato. Calcium was present in none of our samples.

Conclusion

The oxalate content in vegetables vary considerably between plants due to difference in climate, soil quality state of ripeness or even which part of the plant is analyzed. Among our selected vegetable samples, amount of oxalate ion concentration was high in potato compared to others. Low concentration of oxalate ion was found in cauliflower which was a leafy vegetable. A moderate amount was found in ladies finger, cucumber, and cabbage. Nutritive analysis was also found to be fruitful.Healthy individuals can safely consume vegetables, high in oxalate content in moderation, but those with kidney disorders were typically advised to avoid foods high in oxalate. Oxalate can become problematic, however, if they over accumulate inside our body. It is being recommended to limit the intake of oxalate-rich foods, specifically for individuals at risk for kidney stone formation.

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