

## ANALYSIS OF REDUCING SUGAR CONTENT IN FIVE MAJOR TUBER CROPS USED IN 'PUZHUKKU' – A TRADITIONAL FOOD OF KERALA

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### Abstract

Tuber crops are root vegetables that are widely cultivated in various part of world as a food source. Nutritionally, roots and tubers have a great potential to provide economical source of dietary energy, in the form of carbohydrates. They contain different nutrients, vitamins and essential minerals. They also have several bioactivities like antioxidant activity, anti-obesity anti-cancerous, anti-aging and immune modulation activities. From ancient time itself tuber crops constitute a major part in the daily diet of Keralites in the name of 'Puzhukku'. It is a preparation made of different kinds of tuber crops by cooking them by boiling. While boiling, the texture of the tubers changes and become palatable. Five different tuber crops used in puzhukku were screened for analyzing the amount of reducing sugar present in them and also the change in them upon various processing methods.

**Key words:** Diabetes, tuber crops, reducing sugar, Puzhukku

### Introduction

Tuber crops are plants which store edible starch in roots, subterranean stems, rhizomes, corms etc. They play an important role in human diet and are considered as a staple food due to their high adaptation to diverse soil and environmental adaptations with minimum agricultural inputs. As per the study conducted by Anoma Chandrasekhara and Tamilini Joseph Kumar (2016), photochemical in tuber crops have several bioactivities such as antioxidant activity, anti-cancer activity, anti-obesity, anti-diabetic etc. Focusing on the environment and soil in Kerala, tuber crops are highly suitable to be cultivated here. From earlier times tuber crops constitute a major food source of Keralites in the name of Puzhukku. According, in Hindu mythology there was a ritual of preparing 'Karthika puzhukku'. During karthika days people who were fasting for the well being of their family have this tuber crops as puzhukku which provides immediate energy in the form of carbohydrates. In earlier times, the amount of diabetic patients was less compared to present day. This drastic increase in diabetic patients is an outcome of change in food habits and lifestyle. We are living in a consumer world where people mainly rely on instant food items. These dietary habits are one of the major factors for rapidly rising incidence of Diabetes among developing countries. This observation focuses on the importance of traditional food items like

Puzhukku. This study focuses to upgrade Puzhukku as a staple food which can also be consumed by diabetic patients. Major tuber crops that are being analyzed in this study include *Manihot esculenta*, *Amorphophallus paeoniifolius*, *Colocasia esculenta*, *Dioscorea alata* and *Dioscorea esculenta*.

*Manihot esculenta* is one of the most important subsidiary food which is a great source of carbohydrate and less in protein. Eighty percent of carbohydrate produced is starch (Gil and Buitrago, 2002). It ranks fourth of the food crop in developing countries after rice, maize and wheat. 100 gm. of roots provides 160 calories. *Amorphophallus paeoniifolius* is a stem tuber which is a good source of carbohydrates. They have high medicinal value and are rich in vitamins and enzymes. *Colocasia esculenta* is a rich source of dietary fiber, anti oxidants, vitamins, minerals etc. 100 gm. of root provide 112 calories and 4.1 gm. of dietary fiber. *Dioscorea alata* contains 85% of carbohydrates and are rich in manganese. It is an ideal source of protein and energy. *Dioscorea esculenta* contains 83% starch and 12% protein. It contains several vitamins, minerals, alkaloids etc.

### Materials and Methods

Five major tuber crops in Kerala namely *Manihot esculenta* (ME), *Amorphophallus paeoniifolius* (AP),

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*Colocasia esculenta* (CE), *Dioscorea alata* (DA) and *Dioscorea esculenta* (DE) were considered for the present study.

### Selection of Materials

The study materials were collected from the farm lands of Nooranadu locality. Collections were done by digging out the underground tuber carefully without making any injury. The dug out materials were cleaned and preserved.

### Estimation of Reducing Sugar

For the estimation of reducing sugar, three types of samples were used - boiled, steamed and raw. The boiling and steaming were done for 30 minutes. The boiled samples were given the codes MEB, APB, CEB, DAB and DEB. The steamed samples were given the codes MES, APS, CES, DAS and DES.

Reducing sugar content in boiled, steamed and raw samples were analyzed. It was estimated by using Di-Nitro Salicylic acid (DNS) method. DNS reagent was used as the assay. Weighed tissue sample (1 gm.) of each tuber crop was homogenized in distilled water with a mortar and pestle. The pulp was carefully filtered through cheese cloth and made up to 10 ml. using distilled water. The filtrate was centrifuged at 5000 rpm. for ten minutes. From each sample, 0.5 ml was pipette into test tube and 1.5 ml. of distilled water added to make up to 2 ml. Then to this 2 ml. of DNS was added. Another test tube was taken and prepared a blank solution containing 2 ml. distilled water and 2 ml. DNS reagent. It was then heated in a boiling water bath for five minutes. The reaction was noticed by colour change from yellow to orange to red in the test tube containing sample and no colour change in the test tube containing the blank. The samples along with the blank were cooled and added distilled water to make up to 10 ml. and read optical density (OD) at 510 nanometer. The total reducing sugar content was estimated by using the formula

$$\text{Total reducing sugar} = \frac{\text{Con. of std.} \times \text{OD of sample} \times \text{Total volume of extract}}{\text{OD of std.} \times \text{Vol. of sample} \times \text{Weight of tissues}}$$

### Result and Discussions

In the present study five different tuber crops used for the preparation puzhukku were selected. They

were analyzed for the amount and change in reducing sugar during various processing methods.

Study of reducing sugar content of five different varieties of tuber crops in three different forms was conducted (Table1). In raw form, *Dioscorea alata* had shown the highest content of reducing sugar per gram of flesh (27.65 mg.) and *Colocasia esculenta* shown the lowest value (6.60 mg.). In steamed form, the lowest value (4.73 mg.) was observed in *Amorphophallus paeoniifolius* and the highest value (11.83 mg.) in *Dioscorea alata*. *Colocasia esculenta* had the highest reducing sugar content (3.95 mg.) and *Amorphophallus paeoniifolius* had the lowest (1.87 mg.) in boiled form. It was found that on processing, the sugar content decreased markedly. The sugar content reduced more on boiling rather than steamed. Among the five selected tuber crops and in three different forms, the highest reducing sugar content (27.65 mg.) was observed in raw *Dioscorea alata* and the lowest sugar content (1.87mg.) was observed in boiled *Amorphophallus paeoniifolius*.

Among the three samples considered, boiled samples were found to be having less amount of reducing sugar. On boiling, the amount of reducing sugar was found to be decreasing. Boiling does not appreciably reduce the total nitrogen content of potato except for loss owing to peeling. There was a 0.8 percent loss in boiled, unpeeled tuber compared to a loss of 6.5 percent in the peeled tuber (Herrera, 1979).

In the Pacific Islands, there was an ongoing effort to conserve the giant swamp taro, a traditional staple crop. It has been noted that life expectancy in some islands has decreased due to diet-related illness attributed to the movement away from traditional staples. The incidence of diabetes has reached up to 44 percent in Tokelau atolls, while it is only about 8 percent in United States. (Burness Communications, 2010).

### Conclusion

The present study was conducted for analyzing the amount of reducing sugar present in five major tuber crops used in Puzhukku. The study also extended to throw light on the change in the amount of reducing sugar on various processing methods. For the analysis, three types of samples were used - boiled, steamed and raw.

The samples showed variation in the reducing sugar content in three different form of analysis. In raw form, *Dioscorea alata* had the highest and *Colocasia esculenta* had the lowest level of sugar content. In steamed sample also, *Dioscorea alata* had the highest level of sugar content. But the lowest level of sugar content was found in *Amorphophallus paeoniifolius*. *Colocasia esculenta* had the highest and *Amorphophallus paeoniifolius* had the lowest level of sugar content in boiled form.

From the present study it can be concluded that it is advisable to first boil all the selected tuber crop items together in more amount of water before preparing the ‘Puzhukku’. Diabetic patients can preferably consume boiled tuber crops instead of raw or steamed. In both these cooking methods, *Amorphophallus paeoniifolius* is best suitable compared to other tuber crops. Consuming tuber crops individually or in combination alike ‘Puzhukku’, help in providing nutrition to humans.

**Table 1.** Reducing Sugar Content in Tuber Crops (mg./gm.)

Sl. No.	Tuber crops	Raw	Steamed	Boiled
1	<i>Manihot esculenta</i>	12.26	5.98	1.91
2	<i>Amorphophallus paeoniifolius</i>	7.55	4.73	1.87
3	<i>Colocasia esculenta</i>	6.60	6.18	3.95
4	<i>Dioscorea alata</i>	27.65	11.83	2.20
5	<i>Dioscorea esculenta</i>	12.54	9.30	2.82

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