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Study on proximate and nutritional parameters of guava (*Psidium guajava* L.) varieties grown in sodic soil

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Abstract
Guava (*Psidium guajava* L.) is one of the important tropical fruit crops, grown in Tamil Nadu. It is rich source of vitamins, minerals and pectin. With an objective of analysing proximate and nutritional composition of guava varieties *viz.,* Lucknow 49, Allahabad safeda and Arka kiran grown in salt affected soil during 2017. The proximate and nutritional compositions such as moisture, ash, crude fiber content, carbohydrate, protein and fat content of selected guava varieties grown under salt affected soil were studied. Results showed that the highest carbohydrate content (41mg/g tissue) was recorded in Allahabad safeda and lowest content (27.00 mg/g tissue) in Lucknow 49. The highest level of protein content (11.69 mg/g tissue) was observed in Arka kiran followed by Lucknow 49 (10.05 mg/g tissue) and Allahabad safeda *(*9.15 mg/g tissue). Significant level of lipid content was recorded for Lucknow 49 (469.48 µg/g tissue) and a least level in Allahabad safeda (279.20 µg/g tissue). Among the three varieties, Arka kiran recorded the highest moisture content (82.16 %) followed by Allahabad safeda (59%) and Lucknow 49 (48.66%). Highest ash content was observed in Lucknow 49 (10.15%) followed by Allahabad safeda (9.92%) and in Arka kiran (6.4%). Arka kiran and Allahabad safeda recorded closure values for crude fiber content. The findings reveal that the guava fruits have major source of proximate and nutritional composition and this may be considered as a good source of nutrition to the people of all age group.

Keywords: Guava fruit, proximate, nutritional composition and crude fibre

1. Introduction
Ethnomedicine, is referred as study of traditional medical practice, is an integral part of the culture and the interpretation of health by indigenous populations in many parts of the world. For example, Indian Ayurveda and traditional Chinese medicine are among the most enduring folk medicines still practiced. These systems try to promote health and improve the quality of life, with therapies based on the use of indigenous drugs of natural origin. The plants have been widely used as herbal medicines; several approaches are now being carried out to discover new bioactive compounds (Diaz-de-Cerio *et al.,* 2017) [6].

Psidium guajava L. is a fruit bearing plant, which belongs to the family Myrtaceae. It is an important fruit crop of tropical and subtropical regions. Guava excels other fruit crops in productivity and adaptability (Iqbal *et al*. 2009) [2]. It claims superiority and often called as 'Poor Man's Apple' by virtue of its high nutritive value, rich in vitamin C content, antioxidants, dietary fibres and minerals. It is also a potential source of pectin and oil from its seeds. Guava being a climacteric fruit, exhibits a typical increase in respiration and ethylene production during ripening. It softens readily and therefore, has a very short shelf life, which in turn makes transportation and storage difficult (Dube and Singh 2015) [1].

 The plant is described by its particular thin, smooth, copper hued bark that fragments off, demonstrating a greenish layer underneath. Guava trees have spread generally all through the tropics since they flourish in a variety of soils, easily propagating and bearing fruits rapidly. The fruits are appreciated by fowls and monkeys, which scatter the seeds and makes natural dumps of guava saplings to cultivate all over the rainforest (Kenneth *et al.,* 2017) [7].

The Guava (*Psidium guajava* L.) is a therapic plant used in ancient medicine that is believed to have active components that help to treat and prevent various diseases. The many parts of this plant have been used in traditional medicine to manage conditions like malaria, gastroeneteritis, vomiting, diarrhea, dysentery, wounds, ulcers, toothache, coughs, sore throat, inflamed gums and a number of other conditions. This plant has also been used for the controlling of life changing conditions such as diabetes, hypertentsion and obesity (Biswas *et al.,* 2013) [5].

Proximate and nutrient investigation of edible fruit and vegetables plays a fundamental role in assessing their nutritional importance (Pandey *et al.,* 2006) [10]. This study aimed to investigates the proximate and nutritional analysis of guava fruit varieties grown under salt affected soil.

2. Materials and Methods
2.1 Collection of fruit samples
The fruit samples of three guava varieties were collected in the experimental plots of orchard, Horticultural College and Research Institute for Women, Tiruchirappalli, Tamil Nadu, India. The scientific name, family name, name of the varieties and parts used are shown in the Table 1.

Table 1: Details of *Psidium guajava* fruit samples

Scientific name	Family name	Name of the varieties	Parts used
Psidium guajava	Myrtaceae	Lucknow 49	Whole Fruit
		Arka kiran	
		Allahabad safeda	

2.2 Preparation of the sample
The matured fruits were collected and washed with water to remove impurities. Washed fruits were cut into small pieces. Moisture, ash and crude fiber contents were analysed with fruit sample. Hundred gram of fruit was ground with 200 ml of water using mixer and grinder. The suspension was centrifuged, the clear supernatant was used for the analysis of carbohydrate, protein, lipids and mineral constituents.

2.3 Chemicals
All the chemicals used in the present study were of analytical reagent grade

2.4 Estimation of biochemical parameters
The fruit samples were used to analyse the proximate, nutritional and mineral parameters. Moisture, ash and crude fiber contents were determined in accordance with the official methods of the association of official analytical chemists (AOAC, 1999) [3]. Carbohydrate (anthrone method) Sadasivam and Manickam, (2008) [12], protein (Lowry *et al.,* 1951) [9] and lipids (Parekh and Jung, 1970) [11] were assayed using the standard protocols. The minerals (sodium, potassium, calcium and magnesium) analysis was done with Atomic absorption spectrophotometer.

2.5 Statistical analysis
The experimental results were expressed as mean ± standard deviation (SD) of three replications. The data were subjected to one way analysis of variance (ANOVA) and the differences between samples were determined by Duncan's Multiple Range test using the Statistical package (SPSS). Statistical significance was set at $p<0.05$.

3. Results
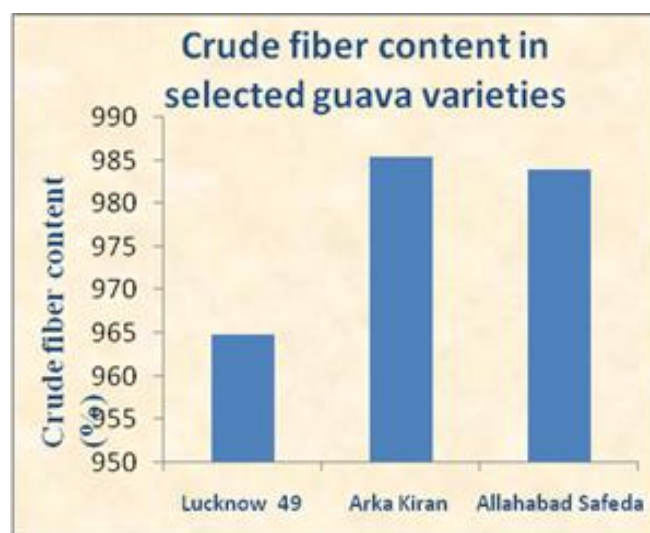### 3.1 Moisture, ash and crude fiber contents
Proximate compositions and minerals play vital role in proper development and good health of human body. Fruit is considered to be the main source of minerals needed in the human diet. Minerals in fruit are some of the important nutrients besides vitamins, flavonoids and phytochemicals which have been reported to contribute to health (Khalili *et al.,* 2006) [8]. The moisture, ash and crude fiber contents of the selected guava varieties are given in Figure 1,2 and 3.
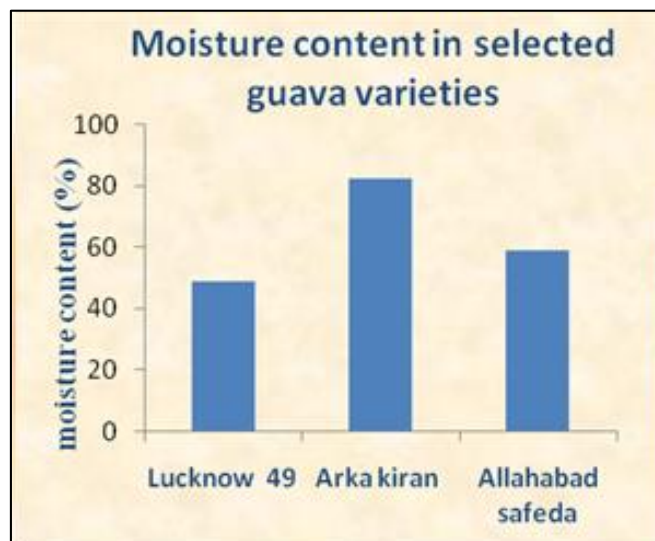
Fig 1: Moisture content in selected guava varieties
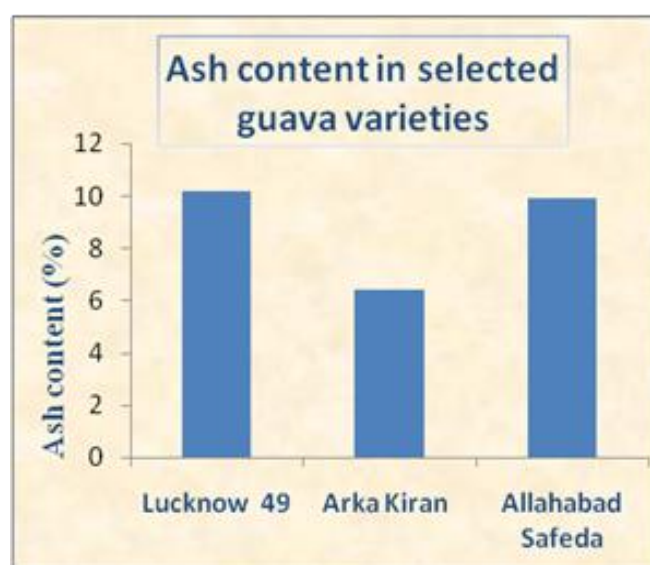
Fig 2: Ash content in selected guava varieties

Fig 3: Crude fiber content in selected guava varieties

Moisture content expressed in fresh matter basis (100 g), the moisture content formed the bulk of tissue weight in the fresh guava varieties, Among the varieties, Arka kiran (82.16 %) recorded the highest moisture content followed by Allahabad safeda (59%) and Lucknow 49 (48.66%). The ash content

value 10.15% was observed in Lucknow 49, followed by 9.92% in Allahabad safeda and 6.4% in Arka kiran. The results showed that, Arka kiran and Allahabad safeda recorded similar levels of crude fiber content and Lucknow 49 contains 964 mg/g tissue of crude fiber.

3.2 Carbohydrate, protein and fat
The total carbohydrate, protein and lipid contents were estimated and the results are presented in the Table 2.

Table 2: Total carbohydrate, protein and fat composition of selected guava varieties

Sl. No.	Samples	Carbohydrate (mg/g tissue)	Protein (mg/g tissue)	Lipid (µg/g tissue)
1.	Lucknow 49	27.00 ± 0.22	10.05 ± 7.93	469.48 ± 33.28
2.	Arka kiran	37.00 ±1.08	11.69 ± 8.38	336.42 ± 11.06
3.	Allahabad safeda	41.00 ±0.82	9.15 ± 7.81	279.20 ± 22.27

The values are mean ± SD of triplicates
a indicates comparison between Lucknow 49 and Arka kiran
b indicates comparison between Lucknow 49 and Allahabad safeda
c indicates comparison between Arka kiran 49 and Allahabad safeda
*indicates significant difference at 5% level ($p<0.05$)

Carbohydrates take part a key role in human diet, comprising about 40-85% of energy intake. Their most essential nutritional significance is easy digestibility in the small intestine. In terms of their physiological and nutritional role, they are often classified as available and unavailable carbohydrates (Shakappa and Talari, 2016). Carbohydrates are one of the most abundant storage compounds in plants and are an important source of food and fiber for humans and feed for animals (Thomas *et al.,* 2017) [15]. The higher concentration of carbohydrate was found in Allahabad safeda (41mg/g tissue) and the lowest was observed in Lucknow 49 (27.00 mg/g tissue).

In the present study, the highest level of protein content was noticed in Arka kiran (11.69 mg/g tissue) followed by Lucknow 49 (10.05 mg/g tissue) and Allahabad safeda (9.15 mg/g tissue). Significant level of lipid content was observed in Lucknow 49 (469.48 µg/g tissue) and a least level was observed in Allahabad safeda (279.20 µg/g tissue).

3.3 Macronutrients
The importance of optimal intake of essential mineral elements to maintain peak health is widely recognised. Inadequate intake of mineral elements has been observed to be a major nutritional problem in our environment. Minerals have many essential roles, both as ions dissolved in body fluids and as constituents of essential molecules (Soetan *et al.,* 2010) [14]. Fruits are valuable sources of minerals. Diets high in fruits are also linked to decreased risk of diseases (diabetes, cancer, *etc*). The composition in macrominerals of the selected guava varieties are represented in the Table 3.

Table 3: Macronutrients in selected guava varieties

Sl. No.	Species	Sodium (mg/g tissue)	Potassium (mg/g tissue)	Calcium (µg/g)	Magnesium (µg/g)
	Lucknow 49	0.941 ± 0.02	1.41 ± 0.09	808 ± 0.01	436 ±0.01
2.	Arka Kiran	2.14 ± 0.05	1.43 ± 0.03	726 ± 0.01	767 ± 0.02
3.	Allahabad Safeda	0.656 ± 0.02	1.40 ± 0.04	1612 ±0.02	192 ± 0.01

The high level of sodium concentration was found in Arka kiran 2.14 mg/ g tissue followed by Lucknow 49 (0.94 mg/ g tissue) and Allahabad safeda (0.65 mg/ g tissue) respectively. Very similar values of potassium were noted in all the three varieties. Calcium and magnesium content plays vital role in different physiological process of plant. The calcium value in Allahabad safeda was higher compared to Lucknow 49 and Arka kiran. Magnesium level was found to be higher in Arka kiran (767 µg/g) than Lucknow 49 (436µg/g) and Allahabad safeda (192 µg/g).

4. Discussion
From the results, guava fruits were shown to have high moisture, ash and crude fiber contents. Reasonable level of carbohydrate and lower level of fat content was found in guava varieties. Similar results were reported by Uzzaman *et al.,* (2018) [16]. This study also showed that guava fruits are rich in macronutrients compared with other fruits like papaya, apple and pineapple. Therefore from this result it could be suggested that guava can be included in the diet therapy which may reduce the chance of diabetes, hypertension and cancer.

5. Conclusion
The present work demonstrates the proximate and nutritional analysis of guava varieties grown under salt affected soil. The results indicate that Arka kiran has highest moisture content than other two varieties of guava. Highest ash content was recorded in Lucknow 49. Comparable values of crude fiber contents were observed in both Arka kiran and Allahabad safeda. The results also indicated that the lower concentration of carbohydrate was observed in Lucknow 49 and high protein content was registered in Arka kiran. High level of sodium in Arka kiran and almost similar level of potassium was found in all the three varieties of guava. This study provides scientific insight to further determine the active principles and investigate other pharmacological properties on guava. On the basis of the present finding, these fruits were proved to be ladled with high level of proximate and nutritional composition and therefore may be considered as a good source of food as well as very good source of antioxidants.

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