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A study on physical and chemical characteristics of guava (*Psidium guajava* L.) Taiwan pink variety

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Abstract
A study was conducted to determine the physical and chemical composition of guava (*Psidium guajava* L.) Taiwan pink variety. The fresh and ripe guavas were selected for evaluation of physical and chemical composition. Results obtained showed that color of guava was green colour with pink color pulp as it has good amount of anthocyanin 143.06 mg/100 g, the fruit is also rich in vitamin C 181.59 mg/100 g. Further chemical composition was analysed and results showed that moisture content found to be 89.28%, carbohydrate 12.4%, protein 2.56%, fat 0.87%. The other parameters such as acidity and pH of guava juice were observed as 0.539% and 3.25 respectively.

Keywords: Physical properties, guava, chemical composition

Introduction
Guava (*Psidium guajava* L.) is a momentous fruit grown in many subtropical and tropical regions all around the world (Rai *et al.*, 2009) [1]. It belongs to family Myrtaceae, this family is further divided in to two subfamilies, including Leptospermoideae, which comprises dehiscent capsulated fruits and Myrtoideae, comprising thickset fruits (Wilson *et al.*, 2001) [2]. Eugenia, Myrcianthes, Campomanesia, and Psidium genera also belong to this family. The Psidium genus contains more than 3800 species of shrubs (Chalannavar *et al.*, 2013) [3]. Guava is an annual plant and the toughest among fruiting trees of tropical areas, and it has high production rate and is most adaptable to any sort of environment (Pino *et al.*, 2004) [4].
It provides food to millions of people around the world. The tree grows fast and starts fruiting within 2 to 4 years. Guava has many medicinal uses that is why it is commonly called the common man's apple (Joseph and Priya, 2011) [5]. It is the fourth most important cultivated fruit in area and production after mango, banana, and citrus. The production of guava in Pakistan is 58.5% thousand ha with the production of 468.3 thousand tones. The guava fruit has moisture content nearly 83% and the range of vitamin C and pectin is respectively (100 – 265 mg/100 g pulp), (0.5 – 1.9%), but has low protein content (1%) and low energy (66 cal/100 g). The fruit is an excellence source of minerals like phosphorous (23- 37 mg/100 g), calcium (14-30 mg/100 g), iron (0.6-1.4 mg/100 g), as well as vitamins like Niacin, Pantothenic acid, Thiamine, Riboflavin, vitamin A.
Parvez *et al.* (2018) [6] discussed common types of guavas include apple guava, yellow fruited cherry guava, strawberry guava, and red apple guava. The fruit guava has various antioxidants that can be a beneficial in preventing many diseases and can help reduce the free radicals in the human body as they act as free radical scavengers. Guava extracts have the potential to act as antioxidants against hepatic diseases as well as cancer. The vitamins that present in guava help the body's improve immunity. Health benefits include the ability to fight against certain diseases like scurvy and thyroid diseases, and it is essential for the brain and eyesight development, along with weight loss. Guava is sold in markets as "super-fruits" which has nutritional importance in terms of vitamins C and A with seeds that are rich in omega-3, omega-6 polyunsaturated fatty acids in the fruit. Since the fruit is rich in nutrients, they can be utilized in many food products.

Materials and Methods
The present investigation was carried out in Department of Food Technology and Nutrition, School of Agriculture, Lovely Professional University, Phagwara, Punjab during the years 2021-2023.

Materials
Raw materials fresh and ripe guava (Taiwan pink variety) were obtained from local village market, Phagwara. The experiments were generally performed immediately after procurement.

Chemicals and glasswares
The chemicals of analytical grade and glasswares required during investigation were used in the department of Food Technology and nutrition.

Methods
Physico-chemical characteristics
Physical and chemical characteristics such as fruit weight, fruit size, TSS, pH, acid content, proximate analysis.

Weight
The weight of the fruits was determined using electronic weighing machine.

Size
The size of the fruit was determined using digital vernier calliper.

pH
The pH was determined by using a digital pH meter after standardizing it with buffers of pH 4.0 and 9.0.

Total soluble solids (T.S.S.)
The fruit pulp/product was uniformly mashed with a mortar and pestle. A drop of mashed pulp was placed on the prism of Digital refractometer and total soluble solids was recorded as °Brix.

Titratable acidity
The titratable acidity was determined by the procedure as reported by Ranganna (2014) [10].

Ascorbic acid
Ascorbic acid content will be determined as per AOAC (2004) [7] using dichlorophenol Indophenol dye.

Moisture content
Moisture content was determined adopting AOAC (2005) [8] method as following:

$$\% \text{ Moisture content} = \frac{\text{Loss in weight}}{\text{Weight of sample}} \times 100$$

Fat
AOAC (2005) [8] method using Soxhlet apparatus was used to determined crude fat content of the sample. The percent of crude fat was expressed as follows:

$$\% \text{ Crude Fat} = \frac{\text{Weight of dried ether soluble material}}{\text{Weight of sample}} \times 100$$

Antioxidant activity
Antioxidant activity (free radical scavenging activity) was measured as per the method of Brand-Williams *et al*. (1995) [9], DPPH (2, 2-diphenyl-1-picrylhydrazyl) was used as a source of free radical. A quantity of 3.9 ml of 6x10 mol/L DPPH in methanol was put into a cuvette with 0.1 ml of sample extract and the absorbance was measured at 515 nm after 30 minutes. Methanol was used as blank. Antioxidant activity was calculated using the following equation.

$$\text{Antioxidant activity (\%)} = \frac{\text{Absorbance of blank} - \text{Absorbance of sample}}{\text{Absorbance of sample}} \times 100$$

Carbohydrate
The total carbohydrate content as per cent dry weight basis was determined by mathematically working out other parameters and then deducting them from 100 (Ranganna, 2014) [10], as follows:
Total carbohydrate (as per cent of dry weight) = 100 - (% crude protein + % crude fat + % crude fibre + % ash content).

Results and Discussion
Physical properties
The data shows various physical properties like weight, length, colour, breath, shape, volume, pulp weight, peel weight was determined and the average values are presented in table 1.

Table 1: Physical properties of Guava

S. No.	Parameters		Guava [Taiwan Pink]
1.	Fruit weight (g)		159.6±15.91
2.	Fruit size	Length (mm)	34.88±4.47
		Breath (mm)	39.716±4.21
3.	Seed weight (g)		1.55±0.39
4.	Seed size	Length (mm)	–
		Breath (mm)	
5.	Volume (ml)		133.8±20.08
6.	Pulp weight (g)		134.53±15.54
7.	Peel weight (g)		21.33±1.172
8.	Visual color		Pink pulp

The physical properties of Guava were measured and results reported that weight was found to be 159.6 (g), length 34.88 (mm), breath 39.716 (mm), pulp weight 134.53 (g), peel weight 21.33 (g) and oval in shape with green color fruit with pink pulp.

Chemical composition of Guava
The data pertaining to various chemical such as moisture, fat, carbohydrates, protein, ash, crude, fibre, pH, TSS, anthocyanin, phenols, flavonoids, and sugars were determined and results obtained are illustrated in Table. 2

Table 2: Proximate composition of Guava

S. No.	Sample	Guava (Taiwan Pink)
1.	Moisture (%)	89.28±0.42
2.	TSS (brix)	11.56±0.20
3.	Total sugar (%)	5.52±0.08
4.	Reducing sugar (%)	3.48±0.03
5.	Acid content (%)	0.539±0.03
6.	pH	3.35
7.	Vit c (mg/100 g)	181.59±0.22
8.	Carbohydrate (%)	12.4±0.20
9.	Protein (%)	2.56±0.25
10.	Fat (%)	0.87±0.02
11.	Crude fibre (%)	4.62±0.05
12.	Total phenolic acid (mg GAE/100 g)	19.56±0.11
13.	Total flavonoid (mg/100 g)	5.57±0.04
14.	Anthocyanin (mg/100 g)	143.06±0.30
15.	Ash (%)	0.29±0.12

Results given in the table 2 indicated that the moisture content was 89.28%, protein 2.56%, carbohydrates 12.4%, crude fibre 4.62% and ash 0.29%. These results were found to be similar to Sato *et al.* (2010) [11]. The chemical composition of guava was analyzed and results revealed that TSS was 11.56 ^{0}Brix, pH 3.35, acidity was 0.539%. The ascorbic acid content of Guava was observed to be 181.59 mg/100 g respectively. The fruit also contains total sugar 5.52%, reducing sugar 3.48, total phenols 19.56 mg GAE/100 g and flavonoid 5.57 mg/100 g. Since the pulp is pigmented, it contains anthocyanin 143.06 mg/100 g. These observations are similar to Rashmi S. and Shukla Y., (2017) [12] with accordance with their findings.

Conclusion

In the present investigation it could be concluded that guava is a good source of crude fibber i.e., 4.62%, protein i.e., 2.56% and carbohydrate i.e., 12.4% and the guava is excellent source of ascorbic acid i.e., 181.59 mg/100 g which makes it potential source for exploration and value addition in food products in combination with various fruits. It also has high amounts of anthocyanin content 143.06 mg/100 g. The fruit is also rich in sugars where total sugars 5.52% and reducing sugar 3.48%. The research shows that the fruit is nutrient rich in nature and can be used in many food products.

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