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Physico-chemical characteristics of fresh banana fruits

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Abstract
The fresh ripe and overripe banana samples were evaluated for various physico-chemical characteristics. Data show that ripe and overripe banana fruits contained total soluble solids (19.40 and 22.20˚B), total sugars (6.75 and 9.59 mg/100 g), acidity (0.42 and 0.32%), pH (4.13 and 5.20), ascorbic acid (3.70 and 2.99 mg/100 g), specific gravity (0.95 and 0.97 g/cm^3), starch (2.53 and 1.51%), crude fibre (1.61 and 1.34%), and total phenols (7.56 and 11.14 mg/100 g). Overripe banana fruits had higher TSS, total sugars, pH, specific gravity and total phenols than ripe banana fruits.

Keywords: Banana, physico-chemical, characteristics, ripe, overripe

Introduction
Banana (*Musa sapientum*, *genus Musa*) is evergreen monocotyledonous, perennial and largest herbaceous plant. It is the staple fruit consumed all over the World apart from grapes, citrus fruits and apples. It is a climacteric fruit, which develops without pollination from inferior ovary of female flower. Banana is one of the most important food crop after rice, wheat and maize, and ranked 4th among the developing countries (Anon., 2002) [3] and after coffee, cereals, sugar and cocoa, it is 5th agricultural food crop in terms of World trade (Forster *et al.*, 2003) [4]. The important banana producing states in India are Maharashtra, Tamil Nadu, Gujarat, Madhya Pradesh, Andhra Pradesh, Karnataka, Assam and West Bengal.

Ripe banana has antioxidant properties and is rich in potassium (342.3 mg/100 g), carotenoids (735 mg/100 g), ascorbic acid (12.7 mg/100 g), citric acid and malic acid (Kumar *et al*., 2012) [8]. Banana has low sodium and fat content, and is used for treating diarrhoea and provides resistance to chronic disease like cardiovascular dysfunction, muscular degeneration and muscle cramps (Wall, 2006; Oguntibeju, 2008) [15, 9].

Banana is delicious and most nourishing of all fruits. It is preferred by people of all ages. It has also several medicinal properties. Many *in vitro* studies, animal model studies and clinical studies showed that various parts of banana act as food medicines for treatment of diseases like diabetes, hypertension, cancer, ulcers, diarrhoea, urolithiasis, Alzheimer's and infections. It helps in treating some emotional and bodily sicknesses, and it contains high amount of iron, which helps to stimulate the production of haemoglobin in the blood, reduces the risk of blood pressure and stroke due to its high potassium and low salt content (Jyothirmayi and Rao, 2015) [7].

It is a cheaper source of sugar and act as starch filler that provides texture and can be supplemented to other fruit juices. The main constraint of adding banana pulp to food products is its discolouration during processing and storage. It is due to oxidation of tannins and activity of polyphenol oxidase on phenolic compounds (Galeazzi and Sgarebieri, 1981) [5]. The enzymatic activity can be reduced or inactivated by the use of chemicals such as potassium metabisulphite (KMS) and ascorbic acid. Keeping in view the medicinal and nutritional importance of banana fruits, the work was conducted to study physico-chemical characteristics of fresh banana fruits for its further utilization and processing into different value added products.

Materials and methods
The present study was carried out in Centre of Food Science and Technology, CCS HAU, Hisar during 2017-18. The ripe and overripe banana fruits were collected from local market,

Hisar for analyzing its physico-chemical characteristics. Total soluble solids (TSS) were estimated at ambient temperature by hand refractometer (0-32%) and the values were expressed as per cent TSS. Total sugars were estimated by the method of Hulme and Narain (1931) [6], acidity was analyzed by the methods of Ranganna (2014) [11] and pH was estimated by pH meter after diluting the sample with distilled water in 1:10 ratio. Ascorbic acid was analyzed by the methods of Ranganna (2014) [11]. The specific gravity of ripe and overripe banana fruits was determined by the method of AOAC (2005) [1]. Starch content of banana was estimated by the method suggested by Ranganna (2014) [11] and crude fibre estimation was done by the standard method by Thimmaiah (2009) [14], while total phenols were estimated as per the methods given by Amorium *et al.* (1997) [2].

Results and discussion

The fresh ripe and overripe banana samples were evaluated for various physico-chemical characteristics and the results have been presented in (Table 1). Ripe and over ripe bananas contained total soluble solids (19.40 and 22.20 ˚B). In overripe stages the TSS was higher than ripe stage and results are in correspondence with Tapre & Jain (2012) [13].

Total sugars of ripe and overripe banana were 6.75 and 9.59 mg/100 g and starch content was 2.53% and 1.51% in the present study. This was due to hydrolysis of starch into sugar during ripening and similar results were reported by (Tapre & Jain 2012) [13].

The acidity (0.42 and 0.32%), ascorbic acid (3.70 and 2.99 mg/100 g) of ripe and overripe banana were in conformity with (Taiwo & Adeyemi 2009) [12].

Crude fiber (1.61 and 1.34%), total phenols (7.56 and 11.14 mg/100 g) and pH (4.13 and 5.20) were recorded in ripe and over ripe banana, respectively.

Specific gravity of the ripe and over ripe banana fruit was found to be 0.95 and 0.97. This change in specific gravity during ripening was due to the fact that depletion of fruit weight is more than the corresponding decrease in its volume as moisture is decreasing. In addition, accelerated biochemical activities that leads to migration of biochemical compound from peel to pulp of the fruit and respiration may contributed to vanish the fruit voids and hence increase in specific gravity. The results are in coinciding with the outcome given by Patil and Shanmugasundarm (2015) [10] who worked on physico-chemical change during ripening of Monathan variety of banana.

Ripe banana had higher total soluble solids, specific gravity, pH, total sugar, ascorbic acid, starch content, total phenol and lower acidity and crude fiber content.

Table 1: Physico-chemical characteristics of fresh banana fruits*

Sr. No.	Parameters	Ripe	Overripe
1.	Total soluble solids (%)	19.4±0.21	22.2±0.12
2.	Total sugars (mg/100 g)	6.75±0.07	9.59±0.09
3.	Acidity (%)	0.42±0.00	0.32±0.00
4.	pH	4.13±0.01	5.20±0.60
5.	Ascorbic acid (mg/100 g)	3.70±0.15	2.99±0.09
6.	Specific gravity (g/cm^3)	0.95±0.03	0.97±0.02
7.	Starch (%)	2.53±0.06	1.51±0.01
8.	Crude fibre (%)	1.61±0.04	1.34±0.02
9.	Total phenols (mg/100 g)	7.56±0.05	11.14±0.05

*The values are mean ± S.D. of three replicates

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