



Original Research Article

Physicochemical Characteristics of Cactus Pear Fruits

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ABSTRACT

Cactus pear fruits of three different region of Gujarat namely Rajkot (CF1), Junagadh (CF2), Anjar (CF3) were studied for physicochemical parameters. Weight, moisture, pH, titratable acidity, ascorbic acid and minerals analyzed from cactus fruits using standard methods. CF-1 was found to possess more weight as compared to CF-2 and CF-3. Also, CF-1 showed higher acidity, ascorbic acid, calcium, magnesium and iron. Zinc and copper were found to be higher in CF-2 and CF-3 showed the highest content respectively. Hence, it could be concluded that as cactus fruits possess good amount of micronutrients and natural colour, they can be utilized to develop value added food products.

Keyword: Cactus pear fruits; weight; moisture; acidity; ascorbic acid; minerals

INTRODUCTION

Although India is one of the world's largest fruit producers, many fruits in India are unknown and underutilized. Cactus pear fruit is one of these underutilized fruit. Cactus Pear fruits (*Opuntia* spp.) belong to the family Cactaceae. Cactus pear consumption is not yet deliberate as it is not familiar in India. It is widely growing fruit. It is native fruit of Mexico and America, but introduced to many drier part of the world. [1]. There are 130 genera and about 1500 species of cactaceae family. These plants are water-use efficient hence, they are highly useful in arid and semiarid environments [2]. In Gujarat, these

fruits are commonly found in Saurashtra and Kutch regions. They are also known as prickly pear, *Indian fig*, *Barbary fig*, *Naghphani* in hindi and *findla* or *hathla* in Gujarati [3].

The cactus pear fruit is an oval, elongated berry with a thick pericarp and has juicy pulp and consistent number of seeds, which are also edible. Cactus pear fruits also serve noticeable sensory attributes. The fruit is sweet and delicious due to its characteristics such as good amount of sugar content and low acidity [4]. Cactus fruits can be eaten fresh or in the form of different food products. Some food products

incorporated with cactus fruits were developed such as juices, jams, ice creams, and extruded food products. [5-8].

Cactus fruit contains good amount of vitamins, minerals, phenolic content and possess significant amount of antioxidant capacity [9-13]. The diet rich in prickly pear cactus showed positive correlation with reduced risk of diseases associated with oxidative stress, such as diabetes, cancer, cardiovascular and neurodegenerative diseases [14].

MATERIALS AND METHODS

Samples

The cactus pear fruits were procured from the three regions of Gujarat namely Rajkot (CF-1), Junagadh (CF-2) and Anjar (CF-3). The glochids (fine, hair-like spines or thorns) were cleaned and removed by heating the fruits on the flame and finally the fruits were washed and wiped.

After washing the whole fruit, it was homogenized and it was used for pH, titratable acidity, ascorbic acid, mineral and colour analysis.

After cleaning, the weight of whole fruit was measured. The fruits were cut vertically and the peel of fruits was removed. After peeling, peel weight and pulp weight were measured. After weighing pulp, the seeds were separated from pulp through sieving and weight of seed was measured.

Colour measurement was done by hunter *L, a, b* colour scale. The instrument was standardized and then the homogenized sample was filled in sample cup. The sample was read for color scale. pH was measured by digital pH meter after the calibration of pH meter. For titratable acidity, the sample was given charcoal treatment for removal of color from the sample and then filtered using what man paper No 1. The clear sample was diluted with water it was titrated with 0.1 N Sodium hydroxide. Moisture was estimated by AOAC method [15] and ascorbic acid content of fruits was measured by titration method [16].

For mineral analysis, appropriate quantity of homogenized sample was taken in crucible and the sample was charred on a flame. After charring the sample it was kept in muffle furnace at 600°C to obtain white ash [17]. The ash solution was prepared by adding 0.5 ml of nitric acid and double distilled water. Calcium, iron, magnesium, zinc, copper were measured by Inductive Coupled Plasma-Optical Emission Spectrometer (ICP-OES).

Statistical analysis

Mean, standard deviation, Analysis of Variance (Duncan) were done to determine the difference between the means and significance was noted at $P < 0.05$ level using SPSS (version-15.00).

RESULTS

The data regarding weight of cactus fruits of three different regions of Gujarat are presented in table-1. The weight of whole fruit was found to be significantly ($P < 0.05$) higher in CF-1 as compared to CF-2 and CF-3. The lowest weight was noticed for CF-3. Also, a significant difference was observed between the weight of CF2 and CF3. A similar finding was recorded for pulp weight and weight of seeds However, no significant difference was noted between CF-2 and CF-3 pertaining to pulp weight and seed weight. Whereas, no significant difference was observed among the peel weight of cactus pear fruits.

Figure-1 depicts the colour content of cactus pear fruits as per '*L, a, b*' colour scale. The Hunter *L, a, b* colour space is organized in cube form. The '*L*' axis runs from top to bottom. The maximum for '*L*' is 100 depicts black shade. Positive and negative '*a*' value indicates red and green shade respectively. While positive '*b*' shows yellow and negative '*b*' value depicts blue colour. '*L*' value of CF1 (6.74) was found to be the highest while CF-3 showed the lowest '*L*' value (5.18). This indicates that CF-1 was darker than CF-2 and CF-3. On '*a*' scale, CF-3 showed the lowest value (6.65) and it was

significantly lower as compared to CF-2 (6.93) and CF-1 (9.94). As higher 'a' value indicates more red shade, CF-1 was found to be redder

than CF-2 and CF-3. A similar observation was also made pertaining to 'b' value.

Table 1: Weight of different fractions of cactus pear fruits

Cactus Fruits	Weight of whole fruit (gm)	Weight of Peel (gm)	Weight of Pulp (gm)	Weight of Seed (gm)
CF-1	24.15 ^c ± 3.66	3.07 ^a ± 0.83	21.07 ^b ± 3.62	1.57 ^b 0.48
CF-2	16.28 ^b ± 2.62	3.19 ^a ± 0.95	12.89 ^a ± 2.06	0.71 ^a ± 0.38
CF-3	12.05 ^a ± 0.46	2.75 ^a ± 0.42	9.30 ^a ± 0.12	0.34 ^a ± 0.08
F. Value	28.22*	0.36 ^{NS}	12.89*	12.32*

Values are mean ± S.D., *indicates significant difference ($p < 0.05$), Values with the different superscript within the column differ significantly ($p < 0.05$).

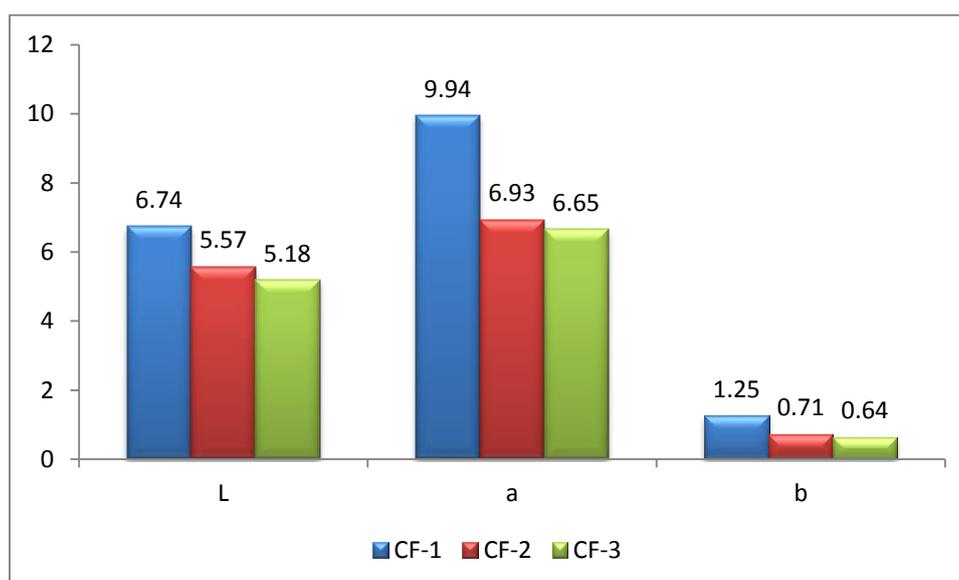


Fig. 1: L, a, b values of cactus pear fruits

Physicochemical properties of cactus fruits from different regions are presented in table-2. Moisture content of cactus pear fruits varied from 84.78 % to 87.25 %. There was no significant difference noticed for moisture content of cactus fruits as per the regional differences. The highest pH was noticed for CF-3 (6.33) and the lowest pH was noted for CF-1 (5.85). A significant ($P < 0.05$) difference was

observed in pH among cactus pear fruits. Concerning titratable acidity, the range of titratable acidity for cactus fruits was found to be 0.72% to 0.83%. The highest acidity was noted for CF-1 which was significantly ($P < 0.05$) higher to titratable acidity as compared to CF-2 and CF-3. No significant difference was found between the titratable acidity of CF-2 and CF-3.

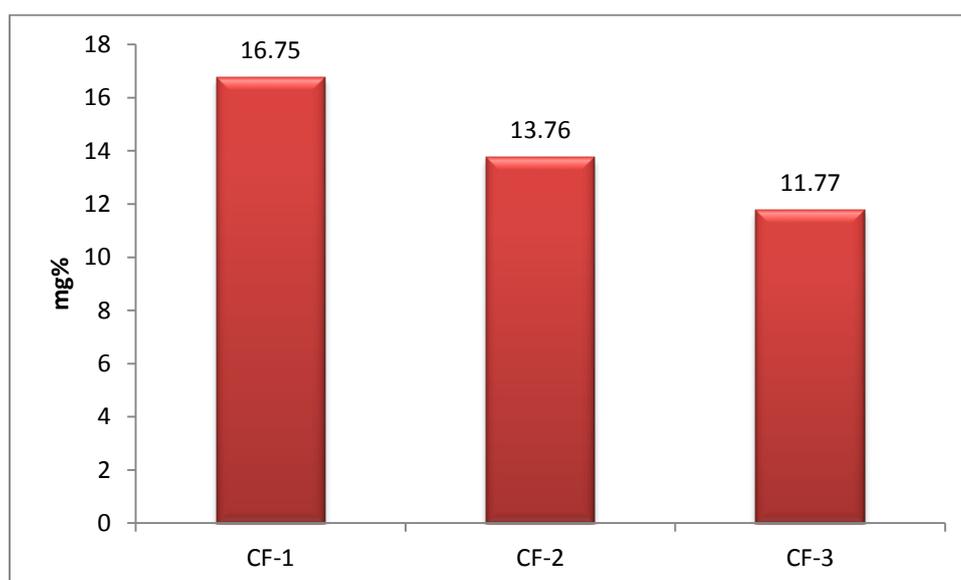
Table 2: Moisture, pH and acidity of cactus pear fruits

Cactus Fruits	Moisture (%)	pH	Titrateable Acidity (%)
CF-1	84.78 ^a ± 0.91	5.85 ^a ± 0.60	0.83 ^b ± 0.005
CF-2	86.46 ^a ± 1.47	6.09 ^b ± 0.06	0.74 ^a ± 0.006
CF-3	87.25 ^a ± 2.83	6.33 ^c ± 0.09	0.72 ^a ± 0.01
F-value	1.729 ^{NS}	41.07*	5.609*

Values are mean ± S.D., *indicates significant difference ($p < 0.05$), Values with the different superscript within the column differ significantly ($p < 0.05$).

The ascorbic acid content of cactus pear fruits is presented in figure-2. CF-1 showed significant ($p < 0.05$) higher ascorbic acid content (16.75 mg %) as compared to ascorbic acid content of CF-2

(13.76 mg %) and CF-3 (11.77 mg %). Also, CF-2 showed significant ($p < 0.05$) higher ascorbic acid content than CF-3.

**Figure-2: Ascorbic acid content of cactus pear fruits.**

The mineral content of cactus pear fruits are presented in table-3. Ash content of cactus fruits ranged from 0.66 gm% to 0.79 gm%. No significant difference was noticed in ash content among the cactus fruits of different regions. A similar trend was observed for the mineral content in each of the fruits. Calcium was found to be the highest followed by magnesium, iron,

copper and zinc. For CF-2, zinc was found to be higher than copper. Comparing the fruits for each mineral, CF-1 contained higher amounts of calcium, iron magnesium, copper than CF-2 and CF-3 while CF-2 showed the highest content of zinc whereas CF-3 showed the highest content of copper.

Table 3: Mineral content of cactus pear fruits

Cactus Fruits	CF-1	CF-2	CF-3
Ash (gm%)	0.79 ^a ±0.01	0.73 ^a ±0.11	0.66 ^a ±0.11
Calcium (mg%)	273.52	207.62	205.51
Iron (mg%)	1.435	1.273	1.103
Magnesium (mg%)	59.83	46.162	41.96
Copper (mg%)	0.2016	0.1250	0.295
Zinc (mg%)	0.1518	0.2043	0.199

Values of ash is mean ± S.D, Values with same superscript within the row do not differ significantly.

DISCUSSION

In the present study, a difference was noticed in physicochemical parameters of cactus pear fruits with regard to regional differences. Dehbi et al. (2014) have also reported significant variation in the physical measurements of cactus fruits of different regions [18].

The colour of fruits may vary as per the cultivar, geographical location and treatment given to the fruits. L*, a* and b* value for orange yellow pulp of cactus pear fruits was 30.60, 1.6 and 10.90 respectively while for red pulp, L* was 25.00, a* was 6.9 and b* was 2.10 [9].

Moisture content of cactus fruits in the present study was nearer to the moisture content reported by Chauhan et al. (2013) [3]. They have mentioned that moisture content of *Opuntia elatior* mill was 86.086 ± 1.23 % w/w. However, a higher range for moisture of cactus fruit juices was mentioned by Dehbi et al. (2014). They reported that cactus fruit juice had the moisture content from 89.13 to 91.18% [18].

Our finding pertaining to pH and titratable acidity are in line with the findings observed in various studies. El-Gharras et al. (2006) reported pH of green, half ripe and ripe cactus fruits. A range of pH for green fruits was 5.95 to 6.07, for half ripe fruits 6.01 to 6.19 and for ripe fruits 6.15 to 6.34. [19]. Albano et al (2015) have also made the similar observation for pH of cactus fruits. They reported pH of orange and purple variety of cactus fruit were 6.02 and 5.89

respectively [20]. A range of pH for nine Moroccan prickly pears was from 5.27 to 5.95 while the total acid content of the different varieties juicy pulp was of the order of 0.46 % to 0.98% as per Dehbi et al. (2014)[18]. The of titratable acidity in the present study was lower than titratable acidity (0.942 ± 0.019 g/100ml) by Chauhan et al.(2013)[3]. A wide range of titratable acidity was noticed by Chalak et al. (2014) [21]. According to them, it was varied from 0.08% to 0.43%.

The findings regarding ascorbic acid in the present study are consistent with the finding of other authors [22-23]. A wide range for ascorbic acid was noted by Kuti (2004). They reported 12.1 mg% to 81.5 mg% of ascorbic acid for four different varieties of cactus pear fruits [22]. Fernández-López et al. (2010) noted ascorbic acid range from 14.5 mg/100g to 23.3 mg/100g for different cultivars of red skinned cactus fruits [23]. A higher ascorbic acid content was reported for orange (30.2 mg%) and purple variety (36.6 mg%) of cactus fruits [20]. The red colour cactus fruit contained more ascorbic acid (53.3 mg%) than purple, yellow and white cactus fruits [24].

With regard to mineral content, Chauhan et al. (2013) [3] have also found higher potassium (131.80 mg%) and calcium (50.24 mg%) content as compared to other minerals. Zinc, iron and copper content of cactus fruits were found to 0.51mg%, 0.32mg% and 0.16 mg%.

CONCLUSION

The present study concludes that cactus pear fruits from different region vary in their physicochemical characteristics. As cactus fruits possess higher levels of ascorbic acid, minerals and colour attributes, they can be used in development of various food products being a potential source of these micronutrients. Also, the natural colouring property of cactus fruit can be promoted in food industries.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interests.

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