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Research Article

PREPARATION AND QUALITY EVALUATION OF FUNCTIONAL PERSIMMON (*DIOSPYROS KAKI*) JUICE FOR DIABETIC PATIENTS

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Abstract

Persimmon (Diospyros kaki) a delicious fruit belongs to Rahmanaceae family. It is a climacteric fruit which is successfully grown in all regions of the world. Persimmon a perishable fruit which is consumed in both fresh and processed forms. It is a rich source of essential nutrients and bioactive compounds such as protein, vitamins, minerals, tannin, flavonoids and carotenoids. The current study was planned to investigate the antidiabetic potential of low calorie persimmon juice under different intervals of time. For this objective persimmon pulp was separated from peel and then it was analyzed for quality parameters. After chemical analysis persimmon pulp revealed that crude protein, crude fat, crude fiber, total phenolic, microbiological contents, calcium, and magnesium were 0.56±0.05%, 0.16±0.02%, 3.85±0.05, 12.41±0.39GAE/g, 4.60±0.26log10 CFU/g, 7.5±0.02mg, 156.5±0.11mg and 8.83±0.03mg, respectively. Persimmon juice was prepared by adding various levels of persimmon pulp. The results showed that the persimmon juice contained a lot of antidiabetic activity. It is concluded that low calorie persimmon juice would be appropriate choice for diabetic patients.

Keywords: Persimmon fruit composition; bioactive compounds; persimmon juice; antidiabetic potential.

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1. INTRODUCTION

In current scenario functional and nutraceutical food products are major source of medicines in a globe. Fruits are uppermost source of these functional food products so their functionality provides protection against various chronic diseases. In worldwide plants derived nutraceutical products are legally recognized in health system as a drug (Guangchang *et al*., 2012). Therefore scientists are fascinated to work on different fruit to judge their capability against infectious diseases. Persimmon (Diospyros kaki) is also known as the fruit of God belongs to the Rahmanaceae family (Mehrotra *et al.*, 2014).

Food is a primary need of all living organisms in the universe. It provides maximum amount of essential nutrients to human body for proper growth. Functional food is a main class of food which is defined as a fortified or processed food containing various bioactive compounds which are helpful against various chronic diseases is also known as functional food. Functional food concept was firstly proposed in 1980 by the name of "Food for specified health us" and then legislated in 1190 (Guangchang *et al*., 2012).

Native country of this fruit is Japan so therefore it is also called Japanese fruit but in recent period China produced more

persimmon as compared to Japan and other countries. In Pakistan persimmon is mostly cultivated in cold region of KPK like Peshawar, Mardan, Malakand, Dir and Swat successfully (Ahn *et al.,* 2002).

Except seed and calyx all parts of the persimmon are consumed in both fresh and processed form because these are rich with nutrients like water, protein, ascorbic acid, dietary fiber, lipid and various trace elements like potassium, magnesium, phosphorus, calcium and iron (Nakagawa *et al.*, 2008). In persimmon fruit dietary fiber is found in huge amount as compared to other nutrients (Novillo *et al*., 2014; Yaqub *et al*., 2013).

Persimmon fruit is categorized into two different forms on the base of taste, color and size. On the base of cultivar persimmon is classified into two main varieties (Radha and Mathew, 2007). These varietal separation is based on the tannin compound (Xing *et al*., 2001). Persimmon color is yellow due to the presence of carotenoid content which enhanced the market value of any fruit (Dembitsky *et al*., 2011). So, rich carotenoids contents are play a vital role in human health. Bioactive compounds are fragrant secondary metabolites which are extensively disseminated in plants (Karaman *et al*., 2014). Persimmon fruit possess highest amount of biologically active substances including flavonoids, carotenoids and tannin. These substances are prevent oxidative stress in body (Baldrick *et al*., 2011).

Stevia is a plant which is belongs to the family of Chrysanthemum which is a family of sweet plant (Mehrotra *et al*., 2014). Stevia has sweet taste and it has no calories. Now days both of these sweeteners are mostly consumed and sucralose is also known as zero calorie sweeteners. Major problem of high calorie sweetener use is a diabetes (Malik *et al.,* 2006; Tian *et al*., 2011). Both sucralose and stevia are 300-400 times sweeter as compared to high calorie sweetener and through consumption of these sweeteners based products diabetes peoples have the same liking for sweet taste.

Therefore low calorie sweeteners are obtained from fruits and vegetables. Tannin compound is present in low amount in non-astringent varieties as compared to astringent persimmon. The non-astringent varieties Maekawa, Lzu and Fuyu are cultivated in all over the world. These are soft in texture and easily consumed before complete maturation due to sweat in taste.

Bioactive compounds are fragrant secondary metabolites which are extensively disseminated in plants. Aromatic hydrocarbons and carboxylic acids are linked with polyphenol compounds .In chemical structure they can be classified into one or more than one phenol units. Total Phenolic substances are play a vital role in human body such as anticancer, anti-diabetic and antioxidant. These are mostly found in the vegetables, fruits, seeds and leaves of plants.

Carotenoids are bioactive compounds that are usually found in fruits and vegetables providing red or yellow color. They are generally occurred in the form of α, β and γ-forms with distinct properties. In Persimmon fruit carotenoid is present in the form of β-carotene which can be further changed into to β-cryptoxanthin.

Both these substance β-cryptoxanthin and β-carotene has fundamental biological importance. Various researchers suggested that β-carotene is a supreme component is found in persimmon. Maximum amount of carotenoid is present in persimmon fruit peel (340mg/100g). Among the carotenoids, β-cryptoxanthin is found in huge amount in persimmon as compared to other carotenoids such as lutein, β-carotene and zeaxanthin. Zeaxanthin, astaxanthin and lutein carotenoids in persimmon fruit prevent the lipid oxidation.

The current study indicated that persimmon juice made by adding sucralose has contained strong activity due to bioactive

substances against diabetes which is leading cause of other chronic diseases like obesity, stroke and cardiovascular diseases (Fiedor and Burda, 2014). However exploration of antidiabetic potential of persimmon juice was the prime goal of my recent research work. This study was planned for the preparation of persimmon juice for diabetic patients and assessment of functionality of persimmon juice**.**

2. Materials and Methods

The present research work was conducted in Microbiology and Safety laboratory in the Department of Food Science and Technology, Muhammad Nawaz Shareef University of Agriculture Multan.

2.1. Procurement of raw material

Persimmon was purchased from local market that was fully matured and uniform in size and weight. Low calorie artificial sweeteners (sucralose and stevia powder) were collected from Essence market of Multan. Persimmon fruit peel was removed and pulp was used for quality evaluation and juice preparation.

2.2. Quality evaluation of persimmon pulp

The percentage composition of persimmon pulp was determined for protein, crude fat, fiber, total phenolic, microbial count and total minerals. According to methods of AOAC, (2000).

2.2.1. Crude protein

Protein contents of Persimmon pulp was estimated through Kjeldahl apparatus by adopting the method of AOCC (2000). About 5ml of sample of persimmon pulp was put in digestion flask. The digestion process was carried for 4-5 hours in the digestion tube into the digestion unit for 4-5 hours and when green color residues are starts to develop in digestion tube then cool the sample and then put into the 100ml volumetric flask. Then neutralize the mixture with almost 70ml of sodium hydroxide solution (NaOH) for purpose of ammonia gas releasing. Then this neutralized solution of sample was distilled in Kjeldahl's distillation apparatus. Then titration process of ammonia was started with 0.1N solution of sulphuric acid until the purple color was appeared. The percentage of crude protein of persimmon pulp was expressed by following equation.

$$\textbf{Nitrogen}(\%) = (\text{Titrate value} \times \text{Normality of sulphuric acid} \times 0.0014 \times \text{Dilution})/(\text{weight of sample} \times \text{volume}) \times 100$$

2.2.2. Crude fat

Fat contents of Persimmon pulp were subjected through Soxhlet apparatus regarding the protocol of which is described by AOAC (2000) Method No 30-25. 5ml sample of persimmon fruit pulp was properly weighed into extraction thimble which was clean on weighing balance and then placed into a soxhlet apparatus. Petroleum ether was used for the extraction of fat and extraction process was carried out for about 5-6 hours. After evaporation of solvent flask was completely dried at 105°C in the hot air oven .After completion of drying sample containing flask was properly cooled in desiccator and then amount of fat is measured. The crude fat was calculated as a % of the dry mass of the persimmon pulp used.

$$\textbf{Crude fat}\ (\%) = \frac{W1 - W2}{W} \times 100$$

2.2.3. Crude fiber

Crude fiber of Persimmon pulp was estimated through the procedure of AOCC (2000) method No. 32-10. In this method weighed 5 ml of fat free persimmon pulp sample and then digested that fat free sample with 200 mL boiling solution with the 1.25% H_2SO_4. After digestion sample is filtered and washed with hot water. This washing process is repeat three times. After digestion sample was put into the muffle furnace at 600°C to complete the churning process. After the completion of churning process sample was placed into the desiccators for controlling the moisture and then sample was again weighed.

$$\textbf{Fiber (\%)} = \underline{W1\text{-}W2 \times 100}$$

W

2.2.4. Mineral determination

Minerals are inorganic compounds. In Persimmon pulp minerals were estimated by following procedure of AOAC (2006). Weighed 5ml sample of persimmon pulp and then placed into a conical flask. After pouring the sample in conical flask then 5ml HCLO4 and 10ml HNO3 sloutions were added into the sample and put the flask on heating chamber for maintaining the temperature of 180°C.Stop heating process when 2-3ml solution was left. After completion of heating process then sample was dilute up to 25ml and run it on flame photometer. Same digested material can be used for running on atomic absorption spectrophotometer. Only K and Na were measured through Flame photometer while Ca and Mg were determined through Atomic absorption spectrophotometer.

2.2.5. Total phenolics

Total phenolic contents of pulp of persimmon fruit were estimated through the procedure which is adopted by Li et al. (2005). Folin Ciocalteu is main reagent for the determination of total phenolics. About 0.1 mL of pulp 7.9 mL of distilled water and 0.5 mL of Folin-Ciocalteu reagent (1:1 with water) were properly mixed with each other's. After the interval of 1 minute almost 1.5 mL of sodium carbonate (Na2CO3) 20 g per 100 mL was added into the previous solution and mixed well. Then solution was incubated at room temperature for 3 hours in the dark before absorbance was read at 765 nm. The total phenolics concentration was determined using gallic acid as standard (mg gallic acid/g) from a calibration curve.

TPC (mg GAE/kg) = GAE (mg/L) [total volume of methanol] x dilution factor
Sample weight (g)

2.2.6. Microbial analysis

Nutrient agar powder (2.7g) was weighed and dissolved in 250 mL distilled. Then mixture was stirred and flask was covered with the aluminum foil. Then the medium was placed in the autoclave for the purpose of sterilization. After completion of sterilization step the, medium was cooled and poured in to sterilized petri plates before solidification. The persimmon pulp sample (1 mL) was taken and 10 fold serial dilutions were prepared. The agar plates were inoculated with sample (from serial dilutions) and incubated at 37°C for 24 hrs. After incubation, the plates were removed from incubator and colonies were counted and total plate count was estimated by using the below mention equation.

Microbial load (c.f.u. /mL)= $\Sigma C/(n\,1 + 0.1n2)d$

2.3. Product development

2.3.1. Persimmon juice preparation

The juice of persimmon were prepared and then in order used to check the antidiabetic activity. The persimmon juice was prepared by using sucralose and stevia powder. In preliminary trials the quantity of these components was optimized. The juice was prepared from optimized levels of above mentioned ingredients given in Table 1. After preparation of juice, it was filled in glass bottles. The bottles were sealed and stored at room temperature for 60 days. The juice was analyzed for different parameters
(as given below) at 0, 15, 30, 45 and 60 days of storage.

2.4. Physiochemical analysis of persimmon juice

2.4.1. pH

The pH basically demonstrates the basic or acidic nature of any solution. pH values are generally in the range of 1-14, where 7 is neutral , 1 is acidic and 14 is highly basic.pH paper and pH meter are basically two common methods which are

Table: 1. Treatment plan

Treatments	Pulp (mL)	Water (mL)	Sucrose (g)	Sucralose (g)	Stevia powder (g)
T_0	20	75	--------	--------	--------
T_1	20	75	4.4		
T_2	20	75		0.6	
T_3	20	75			0.01

Table 2: Mean square of quality evaluation of persimmon pulp

Parameters	Mean±S.D
Protein	0.56± 0.05mg
Fat	0.16±0.02 mg
Fiber	3.85±0.05mg
Total phenolic	12.41±0.39 µL
Microbial contents	4.60±0.26 (cfu /ml)
Calcium (Ca)	7.5±0.02mg
Potassium (K)	156.5±0.11mg

used for the estimation of pH of any food product. Sample of persimmon juice (50mL) was poured into small beaker. Before dipping of electrode in sample was properly washed and pH was noted after stability.

2.4.2. Total soluble solids

Total soluble solids of persimmon juice were estimated thorough refractometer by adopting procedure of AOAC (2000).Juice was poured into the prism of refractometer & readings of total soluble solids were noted.

2.4.3. Brix/acidity ratio

The brix/acidity ratio of low calorie functional persimmon juice was determined in which percentage of TSS of juice was divided by its percentage of acidity.

2.5. Sensory evaluation

Low calorie Persimmon juice was judged for aroma, color, taste, flavor and overall acceptability using 9-point Hedonic Scale by a panel of judges. The panelists were selected from students, employees and teachers of Department of Food Science and Technology, Muhammad Nawaz Shareef University of Agriculture Multan.

2.6. Statistical analysis

All the resultant data of current research study was analyzed statistically through ANOVA by using STATISTIX (Version 8.1) software.

3. Results and Discussions

3.1. Chemical composition of persimmon pulp

The results showed that the persimmon pulp contained dietary fiber, Protein, Fat, Total phenolic, Microbiological load, Calcium, Potassium and Magnesium to be 0.56±0.05mg, 0.16±0.02mg, 3.85±0.05mg, 12.41±0.39GAE/100g, 4.60±0.26$\log_{10}$ CFU/g, 7.5±0.02%, 156.5±0.11mg and 8.83±0.03mg, respectively in Table 2. The results showed persimmon fruit is full of nutritious substances which were in line with the findings of many other researchers. It contains Protein, crude fat, dietary fiber, phenolic substances (Suzuki *et al*., 2005) minerals. The quantities of these contents were also close to the findings of other researchers. The minute differences might be due to the environmental conditions as also reported by Singh and Joshi, (2011). It is mostly consumed fruit in whole of the world. It is a huge source of essential elements like water, protein, ascorbic acid, dietary fiber, lipid and various trace elements like potassium, magnesium, phosphorus, calcium and iron. In persimmon

Table. 3. Physiochemical analysis of persimmon juice

	Treatments	Storage (Days)				
	0	15	30	45	60	0
pH	T_0	4.97±0.01	5.00±0.01	5.00±0.02	4.99±0.01	5.01±0.01
	T_1	4.99±0.02	4.99±0.00	5.01±0.01	5.02±0.01	5.00 ±0.00
	T_2	5.01±0.02	4.98±0.02	5.00±0.01	5.02±0.00	5.00 ±0.00
	T_3	5.01±0.02	4.98±0.02	5.00±0.01	5.02±0.00	5.00 ±0.00
TSS	T_0	14.01±0.00	14.01±0.02	13.99±0.02	14.02±0.00	14.00±0.01
	T_1	14.01±0.00	14.00±0.02	14.00±0.02	14.02±0.00	14.01±0.00
	T_2	13.99±0.01	14.02±0.00	14.02±0.01	14.02±0.01	14.03±0.03
	T_3	14.00±0.00	14.01±0.01	14.03±0.01	14.01±0.00	14.03±0.03
Brix-acidity ratio	T_0	12.99±0.00	13.00±0.02	13.00±0.02	13.02±0.00	04±0.03
	T_1	13.00±0.00	13.00±0.02	13.01±0.02	13.05±0.00	13.03±0.03
	T_2	12.99±0.01	13.01±0.02	13.01±0.01	13.05±0.02	13.08±0.01
	T_3	13.00±0.00	13.02±0.00	13.05±0.09	13.05±0.05	13.09±0.03
Sodium (Na)	T_0	1.21±0.00	1.20±0.02	1.18±0.01	1.20±0.02	1.18±0.00
	T_1	1.20±0.00	1.18±0.01	1.17±0.03	1.16±0.02	1.19±0.00
	T_2	1.20±0.00	1.17±0.00	1.17±0.00	1.18±0.02	1.16±0.00
	T_3	1.20±0.00	1.18±0.00	1.17±0.01	1.15±0.02	1.16±0.03
Iron (Fe)	T_0	0.18±0.00	0.18±0.00	0.17±0.01	0.18.±0.02	0.16±0.00
	T_1	0.18±0.01	0.18±0.00	0.16±0.01	0.15±0.02	0.15±0.02
	T_2	0.18±0.02	0.19±0.01	0.15±0.00	0.16 ±0.02	0.13±0.02
	T_3	0.19±0.00	0.18±0.01	0.16±0.03	0.14 ±0.02	0.14±0.02
Calcium(Ca)	T_0	9.48±0.01	9.47±0.03	9.46±0.01	9.45±0.02	9.44±0.00
	T_1	9.45±0.00	9.43±0.04	9.41±0.01	9.40±0.02	9.38±0.00
	T_2	9.43±0.05	9.41±0.04	9.39±0.03	9.40±0.02	9.34±0.01
	T_3	9.43±0.02	9.41±0.01	9.41±0.00	9.40±0.02	9.34±0.01

fruit dietary fiber is found in huge amount as compared to other nutrients. Persimmon fruit is a great source of antioxidant compounds. Researchers found that tannin compound is present in large quantity as compared to other fruits which have antioxidant potential. Tannin is a major bioactive compound.

3.2. Physiochemical analysis of persimmon juice

3.2.1. pH

The impact of the storage on the pH of juice was observed that highest value was given to the T1 at 45th storage day with mean value of 5.02±0.01 followed by T2 at zero day of storage with mean value of 5.01±0.02. Although the lowest value of pH was indicated in T0 at zero day of storage with mean value of 4.97±0.01 as shown in Table 3. The present result of pH are closely in resemblance to the result of Rehman *et al*. (2014) who found that pH of juice was increased with the storage due to acid hydrolysis such as starch into glucose, sucrose and fructose.

3.2.2. TSS

The storage effect on TSS of persimmon juice found that highest value of TSS was observed in the T3 at 60th storage day with mean value of 14.03±0.03% followed by T2 at 30th day of storage with mean value of 14.02±0.01%. Significantly the lowest value was indicated in T2 at zero day of storage with mean value of 13.99±0.01% as shown in Table 3. The result is in line to the findings of Bhardwaj

Table 4. Sensory evaluation of persimmon juice

	Treatments	Storage (Days)				
		0	15	30	45	60
Color	T_0	9.22±0.01	8.70±0.07	8.32± 0.06	6.51± 03	5.98±0.01
	T_1	9.20±0.07	9.20±0.07	7.90± 0.07	6.37± 03	5.93±0.01
	T_2	7.78±0.13	7.78±0.13	7.40± 0.07	6.24± 01	5.54±0.09
	T_3	8.06±0.13	8.00±0.16	6.86± 0.09	6.16± 02	5.19±0.07
Aroma	T_0	8.28±0.06	7.62±0.06	6.70±0.07	7.62±0.06	7.28±0.13
	T_1	8.70±0.07	7.20±0.07	6.21±0.07	6.80±0.07	7.70±0.16
	T_2	7.28±0.13	7.10±0.07	5.70±0.07	6.10±0.07	6.70±0.16
	T_3	7.50±0.16	7.00±0.09	5.10±0.07	6.00±0.09	6.20±0.7
Taste	T_0	8.19±0.07	7.63±0.05	6.70±0.07	4.81±0.03	4.48±0.01
	T_1	8.70±0.07	7.25±0.07	6.20±0.07	4.67±0.03	4.43±0.01
	T_2	7.28±0.13	6.70±0.07	5.72±0.08	4.54±0.01	4.04±0.09
	T_3	7.50±0.16	6.16±0.09	5.20±0.07	4.46±0.02	3.69±0.07
Overall acceptability	T_0	8.35±0.10	7.06±0.28	6.72±0.07	4.82±0.04	4.48±0.01
	T_1	8.69±0.06	7.26±0.06	6.24±0.10	4.67±0.02	4.43±0.01
	T_2	7.49±0.15	6.75±0.05	5.70±0.07	4.54±0.01	4.04±0.09
	T_3	7.50±0.16	6.19±0.11	5.20±0.07	4.53±0.07	3.67±0.08

and Pandey. (2011), suggested that TSS values of juice were increased during the storage time due to variation in mixture and formation of water soluble pectin fraction and breakdown of polysaccharides into mono and disaccharides.

3.2.3. Brix/acidity ratio

The effect of storage on brix/acidity ratio of juice exhibited that highest value was revealed in the T3 at 60th storage day with mean value of 13.09±0.03% followed by T2 at 60th day of storage with mean value of 13.08±0.01%. Significantly the minimum value was showed in T2 at zero day of storage with mean value of 12.99±0.01% as shown in Table 3. The result of recent research work of brix-acidity ratio was similar to the result of Bhardwaj and Pandey. (2011) who found that brix/acidity ratio was increased with the storage due to splitting of citric acid and ascorbic acid.

3.3. Mineral Composition of Juice

3.3.1. Sodium (Na)

The impact of the storage on the sodium of juice was revealed that highest value was given to the T0 at zero storage day with mean value of 1.21±0.00mg followed by T0 at 15th day of storage with mean value of 1.20±0.02mg. However the lowest value of sodium was indicated in T3 at 45th day of storage with mean value of 1.15±0.02mg as shown in Table 3. These findings are same to the result of Pandey *et al.,* (2009) found that sodium content in a juice is decreased due to passage of time.

3.3.2. Iron (Fe)

The influence of the storage on the iron contents of persimmon juice was found that maximum value was observed in the T2 at 15th storage day with mean value of 0.19±0.01mg followed by T3 at zero day of storage with mean value of 0.19±0.00mg. However the lowest value of iron was indicated in T2 at 60th day of storage with mean value of 0.13±0.02mg as shown in table 3. The present result is same with the findings of Muree *et al.,* (2007) who described that iron contents were gradually decreased due to variation in storage time.

3.3.2. Calcium (Ca)

The obtained Statistical data revealed the effect of storage on calcium of juice exhibited that highest value was revealed in the T0 at zero storage day with mean value of

9.48±0.01mg followed by T0 at 15th day of storage with mean value of 9.47±0.03mg. Although the lowest value was showed in T3 at 60th day of storage with mean value of 9.34±0.01mg as shown in Table 3. The result is similar to the result of Malik *et al*., (2006).

3.4. Sensory evaluation of persimmon juice

3.4.1. Color

The storage result revealed that highest color score of juice was exhibited in the T0 at zero storage day with mean value of 9.22±0.01% followed by T1 at zero day of storage with mean value of 9.20±0.07%. Although the lowest value was observed in T3 at 60th day of storage with mean value of 5.19±0.07% as shown in table 4. The current result is supported with the findings of Salaheddin *et al.*, (1984) who found that color score of the juice is declined with the passage of time due to storage temperature and variation in amount of ingredients.

3.4.2. Aroma

The influence of the storage on the aroma of persimmon juice was found that maximum aroma score was found in the T1 at zero day of storage with mean value of 8.70±0.07% followed by T0 at zero day of storage with mean value of 8.28±0.06%. Although significantly the lowest aroma score was indicated in T5 at 30th day of storage with mean value of 5.10±0.07% as given in table 4. These findings are close to the result of Nisperos and Shaw. (1990).

3.4.3. Taste

The effect of storage periods demonstrated that highest taste score of juice was given to the T0 at zero storage day with mean value of 8.19±0.07% followed by T0 at zero day of storage with mean value of 8.19±0.07%. The minimum taste score of juice was revealed in T3 at 60th day of storage with mean value of 3.69±0.03% as shown in table 4. The current findings are close to the result of Selvaraj *et al*., (1989) found that taste score of juice are declined due to variation in storage temperature.

3.4.4. Overall acceptability

The influence of the storage on the overall acceptance of juice was exhibited that highest acceptability score was given in the T1 at zero day of storage with mean value of 8.69±0.06% followed by T0 at zero day of storage with mean value of 8.35±0.10%. Significantly the lowest acceptance score was indicated in T5 at 60th day of storage with mean value of 3.67±0.08% as shown in table 4. The present result showed that this parameter of juice is declined with the passage of time due to variation in ingredients, storage condition and packaging material. These findings are confirm the result of Mahajan *et al*., (2009).

4. CONCLUSION

Fruit juices industry is the fastest growing area in the world of the beverage industry. Fruit juices are important for human health. From recent research study it was observed that low calorie functional persimmon juice can be made by replacing of sugar with sucralose which is a zero calorie sweetener. Low calorie functional persimmon juice is provides a lot of health benefits to the consumer especially diabetic patients. In this juice hundered percent removal of sucrose is not possible due to presence of different bioactive compounds which are effect the taste and color of the juice but we may able to prepare a juice without addition of sucrose.

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6. Conflict of interest

There is no conflict of interest in my research.

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