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Value added products from sapota: A review

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Abstract
Sapota (*Achras zapota*) being to family Sapotaceae, is one of the major fruit crop. It is a good source of sugar ranges between 12 and 14 per cent. It is popularly known as chikku. The fruits have and Appreciable amount of protein, fat, fibres, calcium, phosphorus, iron, carotene and Vitamin. Several medicinal properties have been ascribed to different part of sapota tree and part of sapota. The tannins in young fruits are used to step Diarrhoea, Tea made from young fruit and the flower is used to treat coughs, colds and diarrhoea. Crushed seed are used as diuretic, Sedative, Sapaforic and Kidney Stones. Bark is use prepare to tea for treating fevers.
Value added product of sapota are sapota squash, sapota jam, sapota slices, sapota butter, sapota cheese, sapota candy, sapota milk shake, sapota powder, sapota biscuit, sapota ice cream, sapota shrikhand, sapota pulp, sapota juice, osmodehydrated sapota slices, sapota nectar, sapota lassie, sapota chocolate, sapota bar, sapota tree chewing gum, sapota toothy - fruity. These are value added sapota product useful for Eyes, Wellspring of energy, Calming agent, Avoidance of certain cancers, Sound bones, Help from Constipation Benefits amid Pregnancy, Haemostatic properties, Hostile to viral and anti- bacterial properties, Hostile to Diarrheal, Emotional wellness, Frosty and Cough, Help in Wight loss, as a detoxifying agent, Tooth cavities. Value added product of sapota need high moisture, generally acidic food that is relatively easy to process and that offers a variety of flavour, aroma, colour and calories but are an excellent source of direct fibres and essential vitamins, and various organic acids, fruit can also act as natural laxatives. Values additional are increased consumer demand regarding health, nutrition and convenience and efforts by food processors to improve their productivity.

Keywords: sapota, tannins, squash, acidic food, vitamins

1. Introduction
Sapota (*Achras zapota*) belongs to family sapotaceae and a popular tropical fruit commercially grown in India. Sapota is a native of tropical America and probably originated from southern Mexico or Central America. In south Mexico, Guatemala and other countries, it is commercially grown for the production of chuckle which is a gum like substance obtained from the latex and is mainly used for the preparation of chewing gum. However, in India, it is cultivated extensively for its fruit value. Among the tropical fruits, sapota is the fifth popular fruit crop in both production and consumption next to mango, banana, citrus and grape. The total area under sapota crop is estimated to 1.50 lakh ha with the production of 12.38 lakh tones (Kumar, 2009) and India is considered to be the largest producer of sapota in the world.
According to chadha (1992) [2], sapota was first introduced in growled village in Maharashtra during the year 1898, from where it has been spread to other parts of the country. The major sapota growing states in our country are Andhra Pradesh, Gujarat, Karnataka, Maharashtra and Tamil Nadu while sapota is extensively grown in Gujarat, coastal Maharashtra and Karnataka. In Gujarat, it is grown on area of 25000 ha with an annual production of 2.36 lakh m.t. whereas in south Gujarat, the area under sapota cultivation is 14000 ha with 1.36 lakh tones annual production (anon., 2007) [1] and its cultivation is mainly concentrated in Valsad, Navsari and Surat districts.

Fig 1: Sapota fruits

Sapota fruit is known for its sweet delicious taste and possesses a delicate characteristic aroma when fully ripe. The fruit is a good source of digestible sugar (12 to 18%) and appreciable source of protein, fat, fibre and minerals like calcium, phosphorous and iron. (Chadha, 2001) [3]. Among the 41 varieties grown all over India, kalipattii an outstanding variety of sapota and popularly cultivated in Gujarat due to its excellent taste and aroma, soft and mellow flesh with less number of seeds, high productivity, continuous fruiting throughout the year, very little incidence of insect-pest and diseases and free from physiological disorders which otherwise very common in other major fruits like mango, citrus, etc.

It is well known fact that in Gujarat, this crop has played a significant role in socio-economic upliftment of both marginal and big farmers. Being an assured and regularly paying crop, and better marketing facilities provided by cooperative societies, farmers from south Gujarat tend to grow sapota for commercial fruit production. Hence, there has been rapid increase in area under this crop in Gujarat and the present production is expected to be doubled in near future. As the fruit production has increased, the disposal of fruit sat reasonable rates during peak harvesting season becomes difficult and the farmers are compelled to sell their valuable produce at very meagre price. Besides this, due to cold sensitive nature of the fruit, bulk of the produce needs immediate disposal for table purpose and is handled at ambient climatic conditions causing considerable postharvest losses.

Being a climacteric fruit, it undergoes rapid ripening changes within 5-7 days after harvesting, during which the fruit becomes soft, sweet, and develops excellent aroma with decline in tannins, latex sapotin, aldehydes and acidity. These changes are associated with increase in the activities of enzymes like catalase and peroxides (chadha, 2001) [3]. Owing to these rapid biochemical changes, the sapota fruits have very poor shelf-life as compared to many other climacteric fruits. Under these circumstances, value addition through under these circumstances, value addition through processing is important for economic utilization of increased production of sapota and conversion of fruits into suitable value added products is the only alternative so that the farmers can get assured price for their produce all the time. The several efforts have been made in past to utilize sapota fruits for preparation of value added products such as dehydrated slices (vaghani and chundawat, 1986; gautam, 1998 and lakkond *et al*. 2004) [13, 4], sapota powder (joshi *et al*. 1993) [6], sapota pulp (kute *et al*., 2000) [7] sapota jam (koli *et al*., 2004 and mulla, 2007) [7, 8] and rts beverage (ram, 2007) [9]. However, little attention has been paid on standardization of recipe of beverages, osmotic concentration for osmo-dehydration of sapota, development of innovative jam like products and pulp residue (waste) utilization of sapota for value addition.

Now-a-days, there has been considerable increase in the consumption of fruit beverages in the world and tropical country like India, fruit beverages such as nectar, squashes play an important role in summer months and become important due to their thirst quenching property apart from the nutritive value. Like many other fruit juices such as mango, orange, pineapple, etc., sapota juice cannot be consumed as such because it contains negligible acids affecting the optimum sugar-acid blend and palatability. The sapota juice therefore, needs to be converted in the form of beverages like nectar and squashes for improving the flavor and palatability of the juice. The acceptability of fruit beverages is very much dependent on the juice content as well as brix: acid ratio in beverage. Hence, standardization of optimum recipe of nectar and squash is most important to develop quality beverages of sapota. Osmotic dehydration is a simpler preservation technique.

Osmotic dehydration is a simpler preservation technique which does not require much sophisticated and expensive equipment's and can be successfully adopted in sapota (Gautama, 1998) [4]. Even at rural areas without much investment, the growers can adopt this technique and convert the excess production into stable dehydrated form. Osmotic dehydration is a useful technique for the production of safe, stable, nutritious, tasty, economical and concentrated product obtained by placing the whole or fruit pieces in sugar solution of high osmotic pressure. The quality of the end product depends to a larger extent on the concentration of sugar solution used for osmosis (Rashmi *et al*., 2005) [10]. Therefore, the studies are necessarily to be carried out to determine the optimum concentration of sugar syrup for the production of Osmo-dehydrated sapota slices. Among the value added fruit products, fruit jam forms an important class of products and is a common dessert consumed in rural as well as urban area. Apart from the conventional types of jams and jellies, other products resembling the jams such as cheese and butter are also made occasionally from guava and apple, respectively which have commercial importance. It is therefore necessary to explore the possibility to utilize sapota fruits not only in the preparation of sapota jam and jelly, but also to introduce sapota cheese and sapota butter as innovative sapota products, if found acceptable to the consumer. During the preparation of sapota beverages, a large quantity of waste material in the form of pulp residue is left over after juice extraction and that has to be utilized for the manufacture of value added products like sapota powder. The sapota pulp residue powder can be used in the preparation of milkshake (Raut, 1999) [11]. Hence, the possibility of utilization of sapota pulp residue needs to be explored to develop a newer category of product i.e. Instant sapota milkshake mix along with the studies on the nutritional qualities and storage behaviour of the product.

With this view, the efforts have been made in the present investigation to standardize different value added products of sapota such as beverages like nectar and squash, osmo-dehydrated sapota slices sapota jam and other related products.

The sapota is a commercial tropical fruit crop, having high nutritive qualities with excellent flavour and delicious taste; hence it possesses high table value. Due to the grittiness of the sapota pulp, it is difficult to process it into commercial stable products. Even though a number of sapota products like dehydrated slices, jam, powder, etc. Have been developed, but not yet popular and available on commercial scale. During the processing, the initial status of the fruit is altered and the compositional status of the finished product has not been studied in detail. Hence, the experiment on the 'value added products of sapota (*Achras zapota*) kalipatti' was undertaken for the further standardization of the value products of sapota.

2. Material and methods

2.1 Sapota Nectar

The well ripened fruits of Kalipatti sapota were peeled and sliced with stainless steel knife. The seeds as well as the central white core were removed and fruit pieces were chopped to obtain pulp. Later on, juice was extracted by squeezing the pulp through twofold muslin cloth. The total soluble solids content in the juice was recorded to calculate the actual amount of sugar, citric acid and water to be added in sapota nectar as per the treatments. The required quantity of cane sugar and citric acid was first dissolved in water, strained

and then mixed with the sapota juice. The nectar, thus prepared was heated gently and potassium Meta bisulphite @ 140 mg/kg of nectar was added. The prepared nectar was filled into pre-sterilized bottles of 200 ml capacity and sealed air tight using crown corking machine. The nectar was then, processed in boiling water for 30 minutes, cooled, labelled and stored at a cool and dry place at ambient temperature conditions.

Flow chart

Selection of ripe fruit
↓
Washing of fruit
↓
Preparation of fruit (Removal of peel, core, seed and slicing)
↓
Extraction of pulp
↓
Extraction of juice
↓
Preparation of product according to the tre
↓
Heating the product for 5 minutes
↓
Addition of preservative (KMS @140 mg/kg of finished product)
↓
Filling the product in bottles and crown corking
↓
Pasteurization of product for 30 minutes in boiling water
↓
Cooling and labelling
↓
Storing the product at a cool and dry place

Fig 2: Process flow chart for sapota Nectar (Relekar *et al* 2011)

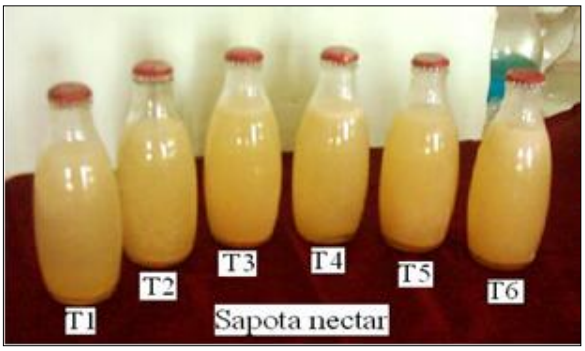

Fig 3: Sapota nectar

2.2 Sapota jam

For the preparation of sapota jam, well ripened, sound and firm 'Kalipatti' sapota fruits were selected, washed, air-dried and peeled manually with the help of stainless steel knife. The peeled fruits were then cut into slices, and seeds as well as inner white core were removed. The sapota slices were then passed through a mixer to get homogenous pulp. Later on, sugar was added to the pulp in the proportion of 1:1 (Pulp: Sugar) and the mixture was heated in a stainless steel vessel. The citric acid was added @ 0.5 per cent of the finished product when the TSS reached to 60°B. Heating was continued till end point was reached at 68.5°B TSS. At the end, the preservative, sodium benzoate was added to the jam @ 200 ppm of the finished product. The jam, thus prepared, was filled hot into the wide mouth pre-sterilized glass bottles of 200 g capacity, closed air-tight and stored at a cool and dry place.

T. Ahmed (2011) an attempt was made to develop sapota jam to assess its prospect in marketability. The fruits were collected from local market and the pulp was extracted in the laboratory. Then the pulp was analyzed monthly for proximate composition. The proximate analysis of sapota pulp showed moisture 70.07%, ascorbic acid 8.90 mg/100g, ph. 5.10, tss 19.4% and total sugar 16.07%. No special change of ingredients was found during two months of storage. But, a little change was observed after four months. The products (jam) with three different formulations (50%, 75% and 100% pulp of the standard formula) were prepared. Sodium benzoate was added as preservative in a required quantity. These products were packed in appropriate container.

The studies on preparation of sapota jam conducted by Koli *et al.* (2004) [7] revealed that jam prepared using 100 g sugar, 10 g pectin and 6 g citric acid per kg pulp had better acceptability after storage of 90 days. A slight decrease in moisture and tannin content in jam was reported with increase in acidity, TSS, reducing and total sugars after 90 days of storage.

The sapota jam could be prepared with a recipe of 2 kg pulp, 1.5 kg sugar, 250 g water and 15- 18 g citric acid (Anon., 1999).

Flow chart

Selection of ripe fruit
↓
Washing of fruit
↓
Preparation of fruit (Removal of peel, core, seed and slicing)
↓
Extraction of pulp
↓
Addition of sugar to the pulp in the ratio of 1:1
↓
Boiling
↓
Addition of 0.5% citric acid & Sodium benzoate @ 200 ppm preservative
↓
Heating till 68.5°B TSS
↓
Filling the product in wide mouthed glass bottles
↓
Cooling, closing and labelling.

Fig 4: Process flow chart for sapota jam and (Anon 1999, Koli 2004 and T. Ahmed 2011) [7].

Fig 5: Sapota jam

2.3 Sapota butter

The method of preparation of sapota butter was just like for sapota jam as given in 3.2.4, except the spice bag with ground spices like cinnamon and cardamom @ 3.0 g per kg of pulp each, clove and black pepper @ 1.5 g per kg of pulp each was immersed in the boiling hot mixture of sapota pulp and sugar in the ratio of 1:1 and 0.5 per cent citric acid. The end point of sapota butter was determined by refractometer test as followed in sapota jam. At the end, the spice bag was squeezed to add spicy extract and flavour to the butter as much as possible. The preservative, sodium benzoate was also added @ 200 ppm of the finished product and the sapota butter was filled in pre-sterilized glass bottles of 200 g capacity, sealed air-tight and stored at a cool and dry place.

Flow chart

Selection of ripe fruit
↓
Washing of fruit
↓
Preparation of fruit (Removal of peel, core, seed and slicing)
↓
Extraction of pulp
↓
Addition of sugar to the pulp in the ratio of 1:1
↓
Boiling
↓
Immersing spice bag in boiling mixture
↓
Addition of 0.5% citric acid & Sodium benzoate @ 200 ppm preservative
↓
Heating till 68.5°B TSS
↓
Squeezing and removal of spice bag
↓
Filling the product in wide mouthed glass bottles
↓
Cooling, closing and labelling
↓
Storing the product at a cool and dry place

Fig 6: Process flow chart for sapota butter

Fig 7: Sapota butter

2.4 Sapota powder

This chapter deals with the literature collected regarding the studies of drying of sapota and similar fruits and vegetables using solar tray dryer and air convecting cabinet dryer. A number of researchers have conducted experiments on drying of fruits and vegetables, to reduce moisture content to desire level for increased shelf life and for further preparation of value added products is also presented here under.

Seema Kumari *et al*., (2012-13) studies on Drying Behavior of Sapota (*Achras zapota*) in Hot Air Cabinet Dryer. Slices of 5 mm thickness and hot air cabinet dryer at drying air temperatures 80˚C, 100˚C and 120˚C. The different drying characteristics were studied in terms of drying curve, drying rate curve and moisture ratio and the proximate analysis was done. The sapota's natural colour, aroma and flavor were close to the fresh sample. The best overall results were obtained in sapota powder of hot air drying at 80˚C. And some chemical observation are comes in TSS, Acidity, Fat, Protein, Carbohydrate. And TSS 18.36, Acidity 0.20(%), fat 1.2(%), Protein 0.83(%), carbohydrate 29(%).

Ganjyal *et al.* (2006) [5] worked on processing of sapota – drying. Fruits were cut in sizes of half, quarter and 5mm slices and dried at temperature of 55˚C, 60˚C, 65˚C and 70˚C in convection air and vacuum ovens. Moisture content of the fruit reduced from 72 to 78% (wb) to 8.5 to 12.5 % (wb) with drying time of 15 to 35 hrs in a convective drying and of 14 to 31 hrs in a vacuum oven. Log and modified log model were fitted for the drying constants as a function of drying temperature and size of samples with good correlation.

Flow chart

Selection of firm ripe fruit
↓
Washing of fruit
↓
Preparation of fruit
(Removal of peel Core and seed)
↓
Extraction of pulp
↓
Extraction juice
↓
Cabinet drying of residue at 60°C
↓
Grinding the dehydrated residue
↓
Sieving through 150 mesh sieve
↓
Packing in aluminium foil laminated pouches
↓
Storing at a cool and dry

Fig 8: Process flow chart for sapota powder (Sema Kumari 2012 and Ganjyal 2006) [5].

Fig 9: Sapota powder

2.5 Sapota Juice

Ripened fruits were washed in tap water, peeled and sliced into small pieces. The sliced fruits were ground into pulp using mixes. The sapota pulp was treated with 70 ppm of potassium metabisulphate, as pre-treatment are necessary to prevent discoloration and microbial growth during processing. The ground pulp was kept under refrigeration (4±1oC) condition before use. A wide range of drinks can be made using extracted fruit juice or fruit pulp as the base material. Many are drunk as a pure juice without the addition of any other ingredients, but some are diluted with sugar syrup.

Flow chart

Fruits (fresh or thawed)
↓
Cleaning & washing
↓
Sorting / culling
↓
Sanitizing
↓
Preparation for extraction
(Pitting, crushing, heating and enzymatic treatment)
↓
Juice extraction (pressing, decanting)
↓
Cloudy juice
↓
Pasteurization
↓
Filling and storage

Fig 10: Process Flow chart Sapota Juice

Fig 11: Sapota juice

2.6 Sapota candy

Fruits were peeled and core was separated from flesh. Core was cut into slices of 1 cm thickness. The slices were washed with water and blanched in boiling water for 5 minutes. The slices were steeped in sugar syrup of 40 percent total soluble solids for about 24 hrs. The pieces were drained out and the strength of syrup was raised by 10 percent total soluble solids, the pieces were again steeped in sugar syrup for 24 hrs. This process was repeated every 24 hrs. Until it reached the desired concentration of recipes slices were steeped in this concentration for a week, when drained and shads dried. The prepared products were evaluated organoleptically to find out the ideal recipe for candy of sapota fruits. About 250g candy was packed in polythene bag.

Flow chart

Sapota fruit core
↓
Slicing (1 cm sized)
↓
Washing with fresh water
↓
Blanching in boiling water (5 minutes)
↓
Steeping in syrup solution each 40, 50, 60, 70 % t.s.s. (24 hrs.)
↓
Steeping in 75 % t.s.s. 7 days
↓
Draining
↓
Shade drying
↓
Packing
↓
Labelling & storage

Fig 12: Process flow chart sapota candy

Fig 13: Sapota candy

2.7 sapota dried slices

Ganjyal *et al.* (2006) [5] reported processing of sapota drying. Fruits were cut in sizes of half, quarter and 5mm slices and dried at temperature of 55˚C, 60˚C, 65˚C and 70˚C in convection air and vacuum ovens. Moisture content of the fruit reduced from 72 to 78% (wb) to 8.5 to 12.5 % (wb) with drying time of 15 to 35 hrs in a convective drying and of 14 to 31 hrs in a vacuum oven. Log and modified log model were fitted for the drying constants as a function of drying temperature and size of samples with good correlation.

Flow chart

Selection of firm ripe fruit
↓
Washing of fruit
↓
Preparation of fruit
(Removal of peel Core and seed)
↓
Slice cut in 5 mm thickness

Cabinet drying of slices at 60°C
↓
Drying
↓
Packing in aluminium foil laminated pouches
↓
Storing at a cool and dry

Fig 14: Process flow chart sapota dried slices (Ganjyal *et al.* 2006) [5].

Fig 15: Sapota dried slices

3. Conclusions

India's sapota production is higher in the world; hence its market value in India is less. Sapota constitutes maximum post harvest losses. Value added products such as juice, vinegar, jam, wine, pekmez and resins increases the economic value of the sapota. These value added products highly accepted in all over the world by consumers in every group. These value added products have high medicinal uses such as controlling diabetes. Shelf life of the value added products are higher than fresh sapota fruits. Sapota products are available throughout the year. Which increases the economical level of the farmers hence the value added product preparation from grape is beneficial

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