



Few novel value added products prepared from fruits of *Garcinia pedunculata* Roxb. ex Buch.-Ham.

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Abstract

Garcinia pedunculata Roxb. ex Buch.-Ham is widely known as *Bor thekera* in Assam, an important fruit of Northeast India under the family Clusiaceae. *Garcinia pedunculata* has dietary importance and widely utilized in the preparation of fish curries by the people of Assam. It has a number of medicinal properties and used as an antiscorbutic, astringent and antidiarrhetic. Due to its high Hydroxycitric acid (HCA) content, it is believed to be useful as natural anti obese agent. In spite of such enormous health benefits, the fruits are underutilized due to their seasonal availability and very short shelf life. Therefore, it is necessary to prepare more value added products from these fruits to take their benefits in off season. In the present work, an attempt has been made by producing a variety of *Garcinia* fruit products applying modern processing techniques blending with traditional knowledge. This will help in increasing the intensity of usage of this fruit and thereby reduce loss due to rot/damage of ripen fruits. The study also evaluated the shelf life and economic qualities of the prepared products. The products prepared from *G. pedunculata* in this study were having potentiality to reproduce as good quality consumer products and may be an income source for village dwelling communities.

Keywords: Fruits, *Garcinia pedunculata*, Processing, Value added products, Shelf life.

Introduction

Edible fruits from wild source play a major role in village economy as they are consumed as added source of diet. Sometimes these are found to sale in local markets. Thus, poor people dwell surrounding the forests could generate additional income also. Some of the wild fruits have considerable amount of antioxidants. While consumes wild fruits the antioxidants ingredients like phenolic compounds, ascorbate and carotenoids are assimilated in the body and evident in lowering of degenerative disease incidences such as cancer, heart disease, inflammation, arthritis, immune system decline, brain dysfunction and cataracts¹. However, in general availability of such wild fruits by and large could determine the dietary behavior of the rural people for domestic consumptions.

Garcinia pedunculata commonly known as *Borthekeera*, in Assam belonging to the family Clusiaceae is an important fruit of North East India. It has greater dietary importance. The ripe fruit is eaten cooked or raw². Usually the ripe or raw fruits are sliced, sun-dried and preserved and prepared sour fish curry³. In Assam, there are several traditional uses of *Garcinia pedunculata* fruit products. One of the most popular traditional preparations is 'tenga diya masor jol' prepared from sun dried sliced fruits of *G. pedunculata*. Such slices are also used for enhancing the flavor while fermenting bamboo shoot locally known as 'Kharisa'. Water extract of dry slices is use as cooling drink taken in warm weather. This drink is reported as an antiscorbutic, astringent, cardio tonic and emollient. Cold water

recipe of dry pericarp is taken as antiarrhoeic, antidiarrhetic, in dyspepsia and in flatulence^{4,5}. It is also believed to be helpful in arresting rheumatic pain. As *Garcinia* fruits are rich in (-) - hydroxycitric acid (HCA), for which, it is reported to use as ayurvedic medicine for ayurvedic reducing female obesity⁶. In spite of these fruits provide enormous health benefits, it is under utilized in our country due to its seasonal availability and very short shelf life.

Therefore, it is necessary to preserve and prepare fruit products for their better utilization the fruits by overcoming the problem of wastage. Seed oil of *Garcinia pedunculata* may be important oil having medicinal properties⁷. The study reveals that a full grown healthy tree can produce on an average 300 kg fruits annually in Assam. The objective of this study was to produce some edible products for value addition to this fruit with the application of modern techniques, besides utilizing traditional knowledge.

Materials and methods

Mature raw fruits of *G. pedunculata* were collected from local forest area, homesteads and local markets of Jorhat, Golaghat, Sivasagar districts of Assam during April – May, 2015. The fruits were washed and cleaned with sterilized water and separated into pulp and seeds. The raw pulps were utilized for preparation of various products like juice, dry powder, jam, squash and pickles at Bio-chemistry laboratory, Rain Forest Research Institute, Jorhat, Assam.

Methodology for preparation of different products:

Garcinia fruit Juice: The Garcinia fruit juice was prepared from the mature fruits pulp using a juicer. The procedure for preparation of fruit juice from mature fruits of *Garcinia pedunculata* is presented in Figure-1.

Initial extraction was raw form of Garcinia fruit juice and also very sour in taste. Therefore, further improvement was done to make the juice tastier and cute by mollification. Ingredient such as approximately 300g of sugar was added to reduce the sourness of the juice. In addition to one drop of commercial food colour was added to improve colour of the product. The fruit juice was pasteurized at 80°C for 30 min to destroy the growth of microorganisms and to inactivate enzymatic activities during storage. The Garcinia fruit juice thus prepared was allowed to cool and then poured into sterilized bottles, sealed to make ready for marketing/ storage. The sealed juice bottles were kept in refrigeration and in room temperature to evaluate shelf life of the product.

Garcinia dry powder: One of the common methods of preserving the fruit is in the form of dry powder. The raw pulps of mature fruits of *G. pedunculata* were sliced into approximately 3mm in thickness and dried in 60° C for 24h in

hot air oven or alternatively sun dried until it lost sufficient moisture to grind. Dried slice of Garcinia fruit pulp needs to grind immediately because it absorbs vapors and become wet again. The powder was prepared from the fruit pulp by the following steps.

Pulverized sugar was added (@750 gm/1 kg of dry powder) and packaging was done in air tight poly begs immediately not to absorb water vapour. Air tight packets of dried powder were kept in refrigeration and in room temperature and evaluated shelf life of the product for the both conditions.

Garcinia fruit Jam: The fruit jam can be prepared from the ripped fruit pulp using sugar as a preservative, by volume reduction methods. For this the ripped fruits of *G. pedunculata* were collected, cleaned with water and then peeled and cut into small pieces. These small pieces were boiled in a pan adding with small amount of water until the pulp turned soft. After that, softy pulps were pulverized and cooked in an uncovered pan until the volume reduced to 2/3rd of its original. Thereafter, pulverized sugar was added (@750 gm/1 kg of fruit pulp) gradually with gentle swirling and boiled to the consistency of jam.

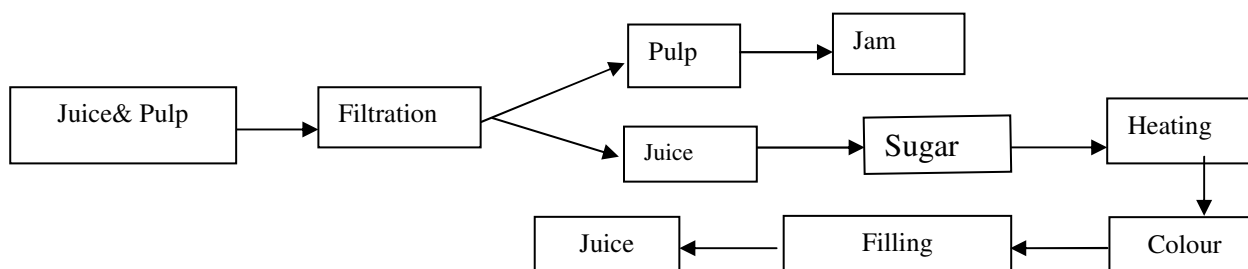


Figure-1: Flow chart on preparation of Garcinia fruit Juice.

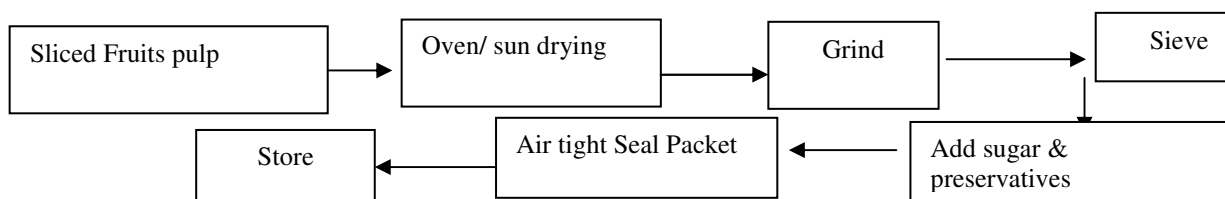


Figure-2: Flow chart on procedure for preparation of *G. pedunculata* dry powder.

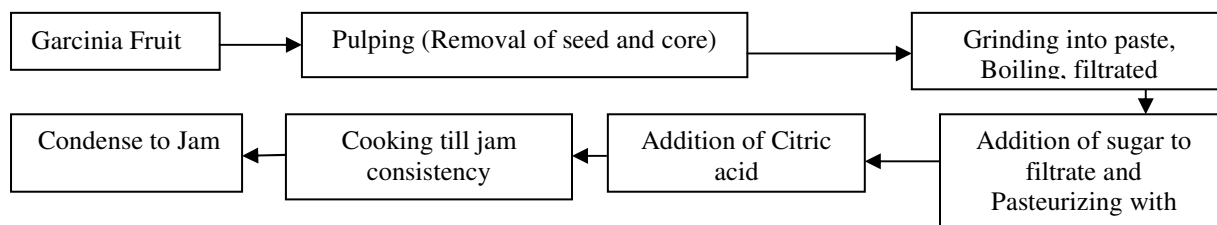


Figure-3: Flow chart on procedure for preparation of Jam from *G. pedunculata* fruit.

The Garcinia fruit jam is found to prepare traditionally by certain Assamese community for their own use. This fruit jam was also prepared by using modern tools and techniques based on this indigenous knowledge. The jam is a powerhouse of taste and health.

Garcinia squash: The squash is a condense form of fruit juice prepared from *Garcinia pedunculata* fruits. For this, ripped Garcinia fruit juice was extracted following the method described as above and added sufficient quantity of sugar, water and boiled this mixture with continuous stirring for 16-20 minutes on a low flame until it condense to half of the volume. The sugar syrup was strained to remove any impurities and then cooled at room temperature. The fruit juice is extracted by using a juicer and immediately added it to the sugar syrup for avoiding the bitter taste of the juice. The squash solution was stored in air tight dark bottles and kept in refrigerator. Air tight dark bottles of Garcinia Squash were kept in refrigeration and in room temperature to evaluate shelf life of the product.

The steps involve in squash preparation is shown in the following flow chart (Figure-4).

The Garcinia squash is the perfect summer drink. The squash is a refreshing, fun drink which will lift your senses and energy levels.

Preparation of spicy and sweet pickles from Garcinia fruit: Mature fruits of *G. pedunculata* were collected and processed for preparation of spicy and sweet pickles using salt as a medium for preservation. During processing cleaned fruits were cut in to small pieces and allowed to dry at 60°C at oven for 4 h and allowed to cool. To this adequate amount of spices such as paste of freshly prepared grinded mixture of garlic, cardamom, red chili, coriander, ginger and small quantity of Ajwain powder were added. Gently cooked the ingredients and added required quantity of sugar/ jiggery with continuous stirring for sweet pickle. Three tea spoonful of vinegar @ 1 kg pickle was added as preservative. Alternatively, for preparation of salty pickle of *G. pedunculata* fruits salt was added instead of jiggery/ sugar. The steps involved in the preparation of pickles are given in Figure-5.

Pickle thus prepared was packaged into air tight container for storage. Air tight canes of Garcinia pickle were kept in refrigeration and in room temperature to evaluate shelf life of the product. The fruit of *Garcinia pedunculata* is incorporated with other fruits to prepare pickles for development of better taste and nutrition.

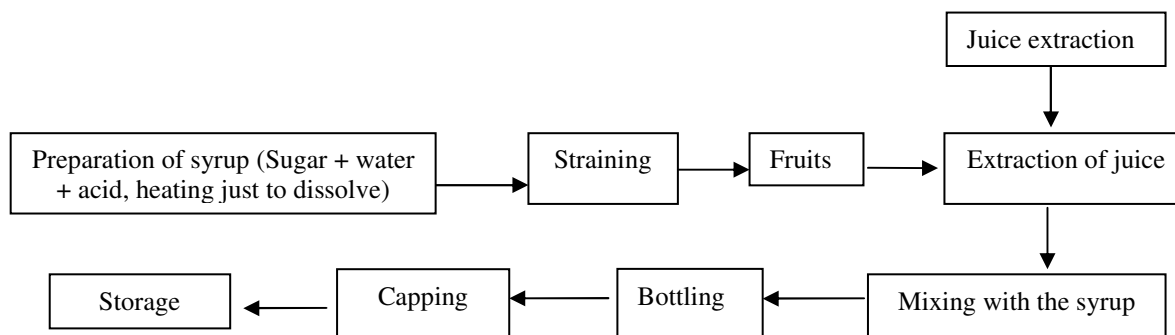


Figure-4: Flow chart for *G. pedunculata* squash.

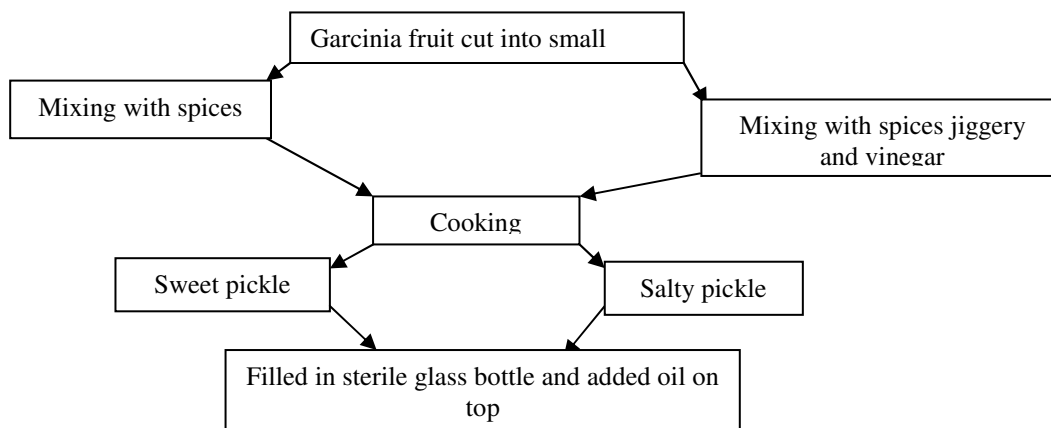


Figure-5: Flow chart for *G. pedunculata* pickle (sweet and salty).

Evaluation of the shelf life qualities of the developed products: Shelf life is the length of time that a food product may be stored without becoming unfit for use, consumption, or sale. The shelf life is counted from the time the food product prepared or manufactured. Shelf life of the products is found to vary depending upon factors such as types of ingredients used, process of manufacturing, aseptic condition maintained and type of packaging and storage condition. For testing the shelf life of the developed products, two sets were prepared and each set was stored in air tight container. The containers were kept in room temperature and refrigerator for a period of 12 months. During the storage time the products were visually examined for detecting any colour change or microbial infestation. After twelve months, the sample products were taken out from its container for analysis and were visually examined for any microbial growth.

Consumer acceptability: Consumer acceptability of prepared Garcinia fruit products were evaluated by offering them products to consume by individuals through sensory testing method in terms of the human senses of sight, smell, taste, touch

and hearing as adopted method⁸. A questionnaire table is prepared and given to the tasters to fill up (Table-1).

Result and discussion

Nutritional analysis of the developed products: Among the nutritional properties carbohydrate, protein, crude fibre and ascorbic acid contents of the value added products were investigated and presented in Table-2. Data of nutritional values of Garcinia pedunculata fruit products developed here revealed to be good source of nutrients. The antioxidant property was also investigated for these products. Highest antioxidant property was recorded in sweet pickles (1394.7µg/mg) and lowest in dry powder (764.8µg/mg). Highest nutritional was recorded for carbohydrates in Jam (9.80) and lowest in dry powder (6.56mg). Among the products high value of per cent crude fibers was recorded for dry fruit powder (2.03%) and lowest in squash (0.56%). Similarly, highest value for vitamin C was recorded for fruit juice (67.52 mg/100g) and lowest in sweet pickle (56.32 mg/100g). Nutritional value /100 gram dry powder contain Vitamin C (60.23mg), Carbohydrate (6.56mg), Protein (1.53mg), Crude fiber (2.03mg) and anti-oxidant value 764.8µg/mg.

Table-1: Results of hedonic rating test taken for any food product.

Score card Hedonic Rating Scale of Product-X								
Product name:			Date of preparation:					
Score value assigned:								
Liked extremely=9, like very much=8, like moderately = 7, like slightly =6, neither like nor dislike = 5, dislike slightly = 4, dislike moderately = 3, dislike very much = 2, dislike extremely = 1.								
Attributes	Score out of 10 for each						Total Score	Average Score
	Tester							
	1	2	3	4	5	6		
Appearance (Colour/ Shape)								
Aroma/smell/odor								
Texture/ mouth feel								
Taste/ Flavour								

(Adapted from UTT, BAFT, B.Sc. Food Science and Technology, Student Project for PROJ2005 Capstone, after 2012).

Table-2: Nutritional analysis of value added products of *Garcinia pedunculata* fruits.

Value added products	Carbohydrate (%)	Protein (%)	Crude Fiber (%)	Vitamin C (mg/100g)	Antioxidant (IC ₅₀ value) (µg/ml)
Garcinia Fruit Juice(GFJ)	8.49	1.99	1.89	67.52	678.5
Dry Fruit Powder (GP)	6.56	1.53	2.03	60.23	764.8
Garcinia Fruit Jam (GJ)	9.80	1.65	1.76	57.40	1087.6
Garcinia squash (GS)	7.98	1.59	0.56	64.32	1054.2
Salty pickles (SLP)	6.45	1.54	1.23	61.43	1243.6
Sweet pickles (SP)	6.78	1.24	1.19	56.32	1394.7

In this study, dry slice, juice, dry powder, jam, squash and pickles were prepared from fruits of *Garcinia pedunculata* (Figure-6). The products evaluated for consumer acceptability and shelf life is presented in Table-3.

Table-3: Shelf life and consumer acceptability of value added products.

Product	Consumer Acceptability (Average score point)	Shelf life	
		Room temperature	Refrigerator
Garcinia Fruit Juice(GFJ)	8.5	10-15 days	10-20days
Garcinia dry powder(GP)	9.0	9 months	12 months
Garcinia Fruit Jam (GJ)	9.0	6 months	9 months
Garcinia squash (GS)	8.0	6 months	12 months
Sweet pickle (SP)	9.0	10months	12 months
Salty pickle (SLP)	8.5	10months	12 months

In the present study different value added products prepared from *Garcinia pedunculata* showed different shelf life (Table-3). All the developed products were superior in terms of nutritive value and shelf life in comparison to those based on the traditional way of preserving by simple sun drying. In normal condition among the *Garcinia* fruits products GFJ showed minimum shelf life with 10-15 days. However, other products reasonable period of shelf life ranging from 6-10 months in normal condition. Consumer acceptability of the products were quite encouraging with the score points ranging from 8.5-9.0 (Table-3).

The data revealed that flavor, palatability and other properties such as texture; appearance and odor of the fruit juice, dry powder, fruit jam and squash were preferred and accepted by the consumers. The pickles of this fruit were also very tasty which can be attractive to the consumer. Although, all the products were finally accepted, because of high quantity of vitamin C. Product like GFJ and GS were found to be acidic (sour) in taste.

That problem can be overcome by diluting the juice pouring water and adding more sugar at the time of drinking. Similar problem of acidity of the juice fruit other than *G. pedunculata* was reported earlier by the researchers and found a bit harsh due to high content of vitamin C⁹. The study revealed that pickles possessed a higher antioxidant property in comparison to other

products prepared from *G. pedunculata* fruits (Table 3). Traditionally, the juice extracted from dried slice (Suthi) is used as medicine for few stomach related disorders¹⁰. The present study also agreed upon the observation¹⁰ that fresh fruit of *Garcinia pedunculata* is not eaten as food or medicine as it insists vomiting & dysentery. Air tight packets of dried powder can be stored for the year due to long shelf life and can be used to prepare refreshing drink as this powdered form is easily dissolve in cold water.

These novel products of *Garcinia pedunculata* can supplement the diet of the rural communities if these products can be made readily available. These products may also be important resources for the future and liable to prove helpful for capacity building of rural poor.

In general, the important of the indigenous fruits has been recognized and documented as they have contributed for reduction of poverty of rural people¹¹. Assam has a large number of indigenous fruits which are mostly unexploited and have the potentiality to use them to reduce malnutrition and develop the wellbeing of rural communities in Assam.

Value added products of the indigenous fruits are again more harmless and long shelf life over unprocessed fruits. If these products can be produced in large quantities, loss of fruits because of unused or damage due to microbial growth and be reduce. In turn the rural economy can be boosted and undernourishment of the village people may also be diminished.

Conclusion

Results of this study revealed that *Garcinia pedunculata* fruit could be a potential source of good quality marketable commercial products. As the fruit is seasonal, mature and ripped in summer season, therefore, adequate measure to be found out to reduce the spoilage due to microbial and physiological activities. All the processed fruit products are superior in nutritive and shelf stability. This fruit can be utilized fully to produce value added products thereby making it available throughout the season as well as in the market which will help to develop our rural economy.

However, the plant is almost going to extinct from natural habitat and found to restrict in the homesteads only but very sparsely. Therefore, domestication of indigenous fruit trees may be a thrust area of research as they have proven potentiality in poverty reduction and hence deserves great attention in planning processes.

Acknowledgement

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Figure-6: Different value added products prepared from *Garcinia pedunculata* fruit. A- Dry slices, B- Powder, C- Jam, D- Fruit Juice, E- Squash and F- Pickle.

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