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Process standardization and development of honey based aonla (*Phyllanthus emblica*) candy

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The present investigation focuses on standardization the process for preparation of aonla candy using honey. Further, sugar was completely replaced with honey. It can be concluded that honey syrup concentration treatments (45°Bx, 50°Bx and 70°Bx) along with 02 per cent alum was found to be suitable to improve the quality of candy. Moreover, cabinet tray drying (60°C) was selected on the basis of chemical composition and organoleptic evaluation for commercial feasibility. Eventually, the prepared candies can be properly stored in standing pouch upto 02 to 03 months without affecting their sensory quality attributes. This honey based aonla candy is nutraceutical rich product that have high energy value and additional health benefits. Therefore, the developed aonla candies can be one of the upcoming value added food products. They may have a good commercial market and subject to catch attention of customers of every age group.

Key Words : Aonla candy, Amla candy, *Phyllanthus emblica*, Honey based candy, Indian gooseberry

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INTRODUCTION

Aonla (*Phyllanthus emblica*), the king of arid fruits, popularly known as Indian. Gooseberry is a minor sub-tropical deciduous tree indigenous to Indian sub-continents. India ranks first in the world in aonla area and production volume. The tree belongs to the family of Euphorbiaceae botanically known as *Phyllanthus emblica.* It is known by different names like Amla, Amalakki, Nelli, Indian Gooseberry etc. The main varieties of amla are Banarasi, Chakaiya, Hathijhool, Bansi Red, Pink-tinged, NA-7 etc. The aonla gets ready for harvesting during November – December. However, the fruit may be allowed to remain on the tree till February without much fruit drops. A fully mature aonla tree may yield 250-300 kg of fruit annually.

Aonla is one of the oldest Indian fruits and considered as "Wonder fruit for health" because of its unique qualities**.** It has played an important therapeutic role from time immemorial and is frequently recommended for its synergistic effects in both the ayurvedic and unani systems of medicine. It is the highest source of vitamin C (478.56 mg/100 ml). In addition to Vitamin C, it also contains calcium, iron, protein and tannic acids, sugar, phosphorus, carbohydrates etc. Aonla primarily contains tannins, alkaloids, phenolic compounds, amino acids and carbohydrates. The fruit also contains considerably higher concentration of most minerals and amino acids than apples. The fruit is highly perishable in nature. Its storage life in atmospheric conditions after harvesting is only 5- 6 days. The fresh fruits are generally not consumed due to their high astringency but it has got great potential in processed forms. Hence, attention has been focused on

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the preparation of different value added products from aonla.

Amla candies have the endurance for as long as about 09 months. Amla candy would be more attractive to consumers because it is more practical to live to eat. It contains a number of nutritive elements and shows superiority with regard to food values. Amla candy is made by immersing pre-treated amla in concentrated sugar solution *i.e.* syrup. The transfer of sugar from syrup to amla and migration of moisture from amla to the syrup is driven by osmotic pressure gradient setup between osmotic solution and the fruit. Osmotic concentration is a simultaneous moisture and solute diffusion process.

Keeping in view the disadvantages associated with excessive sugar consumption, considerable interest is being taken to explore the possibilities of replacing sugar with alternate natural sweeteners. Among natural sweeteners, honey is nutritionally a high energy carbohydrate food considered to be the best source of heat and energy giving over 3200 calories/kg. It is preferred as vehicle of medicine because of its freedom from any adverse effect and easy assimilation. The use of natural honey as food and medicine by mankind has been in existence from time immemorial. Honey is well known for its anti-inflammatory and antioxidant capacities, which may be useful for the prevention of chronic inflammatory process like atherosclerosis, diabetes mellitus and cardio-vascular diseases. Honey has antimicrobial and antifungal properties also (Molen, 1992). Addition of honey can improve the quality of a variety of food products. Honey cakes, honey cookies and biscuits made with honey have pleasant flavour and are much more nutritious than many of sugar based products (Singh *et al.*,1988).

Honey also contains several vitamins, especially B complex and vitamin C, together with a lot of minerals. Some of the vitamins found in honey include ascorbic acid, pantothenic acid, niacin and riboflavin; while minerals such as calcium, copper, iron, magnesium, manganese, phosphorus, potassium and zinc are also present. It also contains other bioactive substances such as phenolic constituents, flavonoids, organic acids, carotenoid-derived compounds, nitric oxide (NO) metabolites, amino acids and proteins. The glycemic index of honey varies from 32 to 87, depending upon biological origin and on fructose content. Low glycemic index foods have thus been shown to improve the glucose intolerance in diabetic subjects.

METHODOLOGY

Freshly harvested Aonla fruits (Var. Krishna) were procured from local market. Krishna variety is moderate in keeping quality, hence selected for preparing candy (Pathak *et al.,* 2003). Crude honey, sugar and alum required for product preparation were purchased from local market. The suitable packaging materials *i.e.* standing pouch of 250 gauge for the purpose of study were obtained from local market.

Preparation of aonla candy:

Healthy, disease, pest and bruise-free aonla fruits were selected for the processing of aonla candy. Fruits

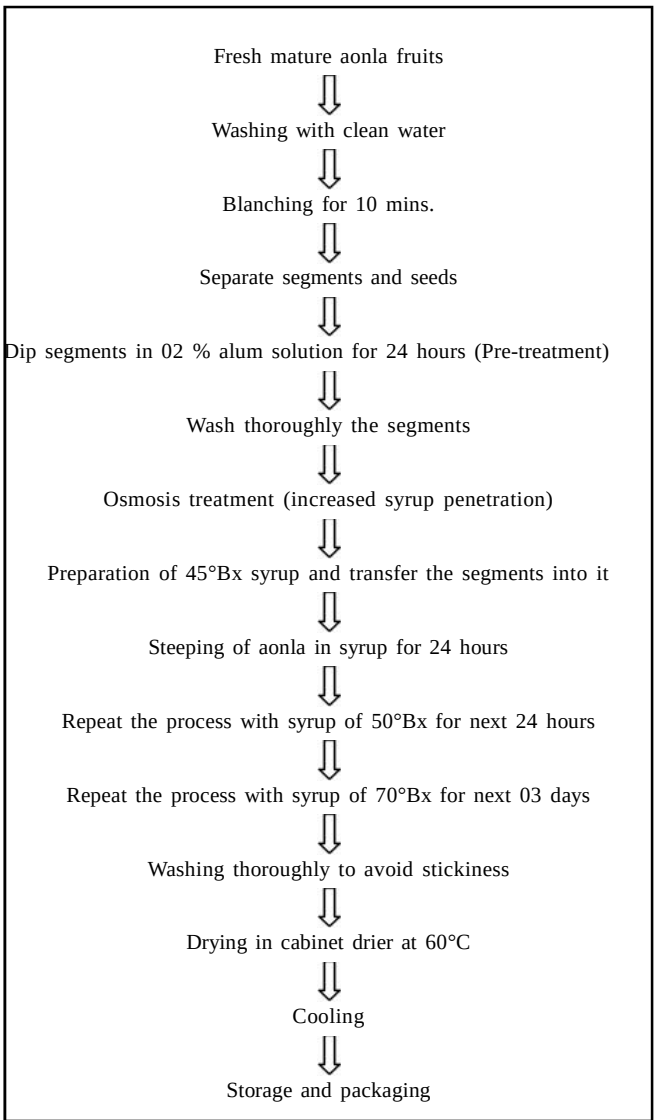

Fig. A: Flow sheet for preparation of aonla candy

were then washed properly in running water to clean the fruit. Fruits were blanched in boiling water for 10 min. (Geetha *et al*., 2006). Then seeds were removed and segments were separated as suggested by (Kumar and Singh, 2001). The blanched segments were steeped in 02 per cent alum solution for one day. Proper washing was done to remove the traces of alum on the next day. The product was prepared by dipping the segments in successive increasing concentrations of sugar syrup at room temperature till equilibrium at 70°B was reached as per the method described by (Tandon *et al*., 2006). Firstly, 45°Bx sugar syrup was prepared to which pre-treated segments were transferred. After soaking for 24 hours, the segments were taken out and same syrup was boiled to the concentration of 70°Bx, which was cooled and transferred to the fruit segments. The product was kept for next 03 days. On the fourth day, the osmosed segment were separated out from syrup and washed thoroughly to remove surface syrup to avoid stickiness. The segments were spread on the aluminium trays with some spacing uniformly. And drying was carried out at 60±2^{0}C in a cross flow cabinet tray dryer with air velocity of 1.2±0.1 m/s. When the sufficiently dry and leathery texture was achieved, product was removed from dryer and cooled to ambient temperature. It was immediately packed, sealed and stored. The research project has been designed to study the consequence of replacing common cane sugar with natural sweetener honey.

Formulation of recipe of Aonla candy:

Method comprised of first syruping treatment at 45°Bx for 24 hours, followed by second syruping treatment at 50°Bx for next 24 hours and eventually third syruping treatment at 70°Bx steeped for 72 hours.

Table A : Standardized syrup concentration

Syruping treatment	° Brix	Steeping period
1st	45	24 hours
2nd	50	24 hours
3rd	70	72 hours

OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Physico-chemical and nutritional parameters of aonla fruit:

During present investigation, aonla fruit of Krishna variety was selected for the development of aonla candy. It is because var. Krishna is most suitable for the preparation of quality product candy as reported by Nayak *et al.* (2009) on the basis of the observations recorded on various biochemical characters and organoleptic quality. The physical characteristics of fresh fruits are depicted in Table 1.

Table 1: Physical characteristics of aonla fruit

Parameters	Observations
Colour	Light greenish yellow
Diameter (cm)	3.78
Height (cm)	3.50
Fruit weight (g)	15.58
Seed weight (g)	1.40
Pulp weight	90% of the fruit weight

Each value is an average of three determinations

The colour of selected aonla fruit is observed of light greenish yellow which will be highly reflected in the final prepared candies. The aonla fruit had weight of 15.58g whereas the weight of pulp was found to be 90 per cent.

Data reported in Table 1 is in well agreement with the data obtained by Indian Medicinal Plants (1997) elaborated as the *Phyllanthus Emblica* fruit is light greenish yellow, spherical and appear to be much hard and the taste of fruit is sour. Fruits are fleshy, pale yellow with six obscure vertical furrows enclosing six trigonous seeds.

Each value is an average of three determinations:

The nutritional composition of Aonla fruit (var. Krishna) was estimated and presented in Table 2. Data in table revealed that Krishna variety amla fruit contain 83 per cent moisture content. The highest mineral content especially in calcium, phosphorus, iron along with highest vitamin C content in selected Aonla variety fulfills the nutritional enrichment in the final processed product *viz.*, aonla candies. The total mineral matter in fruit is 0.80 per cent, which is composed of majorly iron (1.5 mg/ 100g fruit), calcium (0.045%) and phosphorus (0.025 %). Moreover, aonla fruit contain 3.2 per cent polyphenol and 423.65 mg/100g ascorbic acid was occurred. The results obtained were found more or less similar to those reported by Dachiya and Dhawan (2001). It can be seen from the

Table 2: Proximate chemical and nutritional composition of aonla fruit

Parameters	Observations
Moisture (%)	83.0
Total soluble solids (°Brix)	8.9
Acidity (%)	1.5
Protein (%)	0.65
Fat (%)	0.12
Mineral matter (%)	0.80
Fibre (%)	3.50
Carbohydrate (%)	14.65
Calcium (%)	0.045
Phosphorus (%)	0.025
Iron (mg/100g)	1.5
Ascorbic acid (mg/100g)	423.65
Polyphenol (%)	3.2

Each value is an average of three determinations

table that the total soluble solids and acidity was found to be 8.9° Bx and 1.5 per cent, respectively in the selected amla fruits. Similar results regarding nutritional composition of aonla fruits are reported by Bharthakur and Arnold (1991); Singh *et al.* (1993) and Jain and Khurdiya *et al.* (2009).

Effect of syrup concentration on sugar based aonla candy (S_1) and honey based aonla candy (H_1):

Table 3. revealed that after first syrup treatment, highest water loss (42.90 %) and highest solid gain (38.25 %) in H_1 sample after 3rd day syrup treatment. It may be due to higher syrup concentration. Water loss and solid gain are also increased with the rising concentration of osmotic agent. Further, the increase in sucrose concentration resulted in an increase in the osmotic pressure gradients and hence, higher water loss and solid gain uptake values throughout the osmotic period was obtained (Ispir and Togrul, 2009). Similar results are also reported by Falade *et al.* (2007) who monitored the mass transfer during osmotic dehydration of watermelon slabs at three different sucrose concentrations (40°Bx, 50°Bx, and 60°Bx). Similar results with respect to change in water loss and solid gain are reported by Rastogi *et al.* (1997) that water loss and solid gain increased with increase in osmotic solution concentration attributed the increased mass transfer of sugar molecules with increasing concentration to possible membrane swelling effect, which might increase the cell membrane permeability.

Organoleptic quality of prepared aonla candy:

Organoleptic evaluation was done by 9 point hedonic scale for various quality attributes which decides the suitability of syrup concentration for preparation of aonla candy. The average scores of organoleptic evaluation are depicted in Table 4.

The results of sensory assessment showed that the perception of the quality of product varied significantly with the osmotic agent as well as syrup concentration (by varying °Bx). Sensory scores for H_1 sample was found to be highest for all parameters among other sugar based candy samples. Highest score obtained in overall acceptability (9.5) showed that it as highly accepted by judges.

Table 3 : Effect of syrup concentration on sugar based aonla candy

Sample	After 1st syrup treatment			After 2nd syrup treatment			After 3rd (day) syrup treatment		
	Syrup Conc. (°B)	WL* (%)	SG** (%)	Syrup Conc. (°B)	WL* (%)	SG** (%)	Syrup Conc. (°B)	WL * (%)	SG** (%)
S_1	45	19.85	16.20	50	26.65	22.35	70	40.45	36.50
H_1	45	22.50	16.40	50	30.60	23.95	70	42.90	38.25

WL*: Water loss, SG**: Solid gain

Table 4 : Organoleptic quality of prepared aonla candy

Samples	Appearance	Colour	Taste	Flavour	Texture	Overall acceptability
S_1	8.5	8.0	8.5	8.2	8.2	8.5
H_1	9.0	9.2	9.5	9.5	9.0	9.5
S.E.±	0.126	0.128	0.128	0.115	0.113	0.115
C.D. (P=0.05)	0.35	0.35	0.35	0.32	0.312	0.32

Each value is an average of ten determinations

Physico-chemical and nutritional parameters of aonla candy:

Aonla candy can be categorized under intermediate moisture food. Generally, intermediate moisture food (IMF) contains moderate levels of moisture of the order of 20 to 50 per cent (Vora *et al.*, 2003). The IM foods have an acceptable eating quality and reasonable storage stability under ambient conditions (Iman *et al.*, 2011). The data pertaining to the results of physico-chemical and nutritional analysis of selected Aonla candies (sugar based and honey based) is presented in the Table 5.

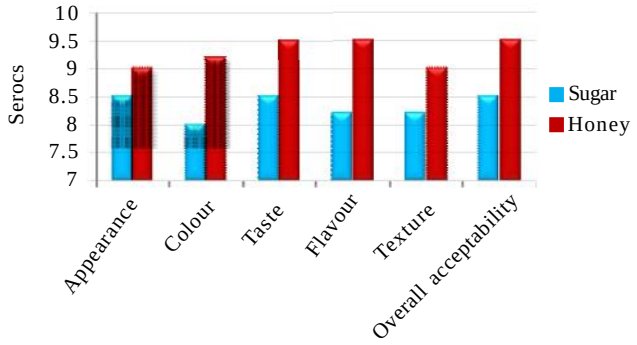

Fig. 1 : Organoleptic quality of prepared aonla candy

Table 5 : Physico-chemical and nutritional parameters of aonla candy

Parameters	Sugar based aonla candy (S_1)	Honey based aonla candy (H_1)
Moisture (%)	24.30	24.98
T.S.S (°Bx)	74	73
pH	3.50	2.59
Acidity (%)	0.50	0.55
Protein (%)	0.35	0.40
Fat (%)	0.10	0.12
Crude fibre (%)	3.1	3.5
Carbohydrate (%)	70.50	72.95
Total sugar (%)	65.35	67.55
Reducing sugar (%)	38.05	45.30
Non-reducing sugar (%)	27.35	22.25
Ascorbic acid (mg/100g)	242.75	262.75
Iron (mg/100g)	0.60	2.37
Calcium (mg/100g)	43.87	81.20
Magnesium (mg/100g)	18.63	2.19
Phosphorus (mg/100g)	7.16	44.8
Potassium (mg/100g)	189.75	425.7
Sodium (mg/100g)	8.1	10.9
Energy value (kcal/100g)	284.44	294.39

Each value is an average of three determinations

Honey and aonla combination is observed as pleasant golden yellow in colour. It is with high nutritional profile. Higher moisture content is noticed than sugar based aonla candy but within the acceptable range (23-25 %). The protein, fat and crude fibre are found to slightly higher as compared to sugar based aonla candy due to replacement of sugar with honey that is further consists of proteins and fat. The sugars in honey are reported sweeter and give more energy than artificial sweeteners (White and Doner, 1980; Ajibola *et al.*, 2007 and Bogdanov *et al.*, 2008). Therefore, the next important parameter that is total sugars is found to be increased as a result of osmosis. Further, penetration of solute during osmosis and higher content of reducing sugar in honey itself is responsible for the considerable increase in reducing sugar content as compared to sugar based Aonla Candy.

Further, honey based aonla candy retained fairly good amount of ascorbic acid. The consumption of food and substances rich in antioxidant can protect against cellular dysfunction, pathogenesis of metabolic and cardio-vascular diseases as well as aging (Al-Waili, 2003 and Schramm *et al.*, 2003). Moreover, ascorbic acid is important to prevent some diseases like scurvy.

Sugar molecules in honey are in pre-digested forms, and can be directly absorbed into the human system. According to a recent study, honey was well tolerated by patients with diabetes of unspecified type (Bejan *et al.*, 1978) and on diabetes type-2 patients (Bornet *et al.*, 1985). Moreover, Ajibola *et al.* (2007) reported improved haemoglobin concentration (iron constituent of honey played an important role in this), increased erythrocyte count and elevated haematocrit in the honey eaters. This directs the interest to assess mineral content and reported a considerable amount of iron. Honey based candy consists of 80-85 mg/100g calcium and 2.1-2.3 mg/100g magnesium on an average. Phosphorus, potassium and sodium present is more than sugar based candy. The total energy provided by 100 g of aonla candy was calculated theoretically by multiplying carbohydrate and protein with factor 4 and fat with 9 to obtain energy yielded in kcal (Gopalan *et al.*, 2004). The total energy obtained per 100 g of honey based aonla candy is 294.39 kcal is more than sugar based aonla candy (284.44 kcal).

Conclusion:

The present investigation focuses on standardization

the process for preparation of aonla candy using honey. Further, sugar was completely replaced with honey. It can be concluded that honey syrup concentration treatments (45°Bx, 50°Bx and 70°Bx) along with 02 per cent alum was found to be suitable to improve the quality of candy. Moreover, cabinet tray drying (60°C) was selected on the basis of chemical composition and organoleptic evaluation for commercial feasibility. Eventually, the prepared candies can be properly stored in standing pouch upto 02-03 months without affecting their sensory quality attributes. This honey based aonla candy is nutraceutical rich product that have high energy value and additional health benefits. Therefore, the developed aonla candies can be one of the upcoming value added food products. They may have a good commercial market and subject to catch attention of customers of every age group.

Hence, it is finally concluded that developed processing technology for preparation of aonla candy is techno economically viable and therefore, can be commercially exploited.

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