

Anthocyanin enriched guava nectar: An alternative source of antioxidant biofortification

The ratio of 50:50 of guava and coloured grape blends is most acceptable for the preparation of anthocyanin rich guava nectar with maximum retention of anthocyanins, flavour and other nutrient retention. Coloured grape juice has anthocyanins in abundance and relatively inexpensive source for natural colouring of food and beverage products. However, during storage, coloured bottles performed better over transparent bottles with respect to sensory and nutritional qualities of the nectar irrespective of the storage conditions. Therefore, blending of two or more fruit juices and their beverages are thought to be a convenient alternative for their utilization in order to have novel and appealing value-added fruit drinks, which are of high quality in respect of both sensory and nutraceutical properties and can be a new entrepreneurial venture for youths.

TROPICAL fruits are gaining popularity due to their potential health benefits and exotic flavours. Among the tropical and sub-tropical fruits, guava and grape have a good production potential and provide enormous scope for preparation of several novel value-added products with good taste and flavour. Guava contains very high amount of vitamin C, folic acid, pectin, calcium and phosphorous. Similarly, coloured grapes have excellent natural pigments due to the presence of anthocyanins, phenols, tannins and betalains in their pulp. Similarly, guava has excellent digestive and nutritive value, pleasant flavour, high palatability and availability in abundance at moderate price. While coloured grape juice has abundant anthocyanins, tannins and high levels of antioxidant properties, it is relatively inexpensive source for colouring food and beverage products. Therefore, blending of two or more fruit juices and their blended beverages (nectar, RTS) are the convenient alternative for their better utilization in the form of value-added fruit drinks, which have high nutritive quality.

Guava is widely cultivated all over the tropical and sub-tropical areas of India. Its fruit consists of 20% peel, 50% pulp and remaining portion as seed core. Guava fruits are normally consumed as fresh and dessert fruit due to excellent flavour, high digestive and nutritive value, high palatability

and availability. Guava is often marketed as “super-fruits”, which has a considerable nutritional importance in terms of vitamin A and C. The high content of vitamin C (ascorbic acid) in guava makes it a powerhouse in combating free radicals and oxidation that are key enemies to many degenerative diseases. Ripened guava fruit have short shelf-life (3-5 days) and thus suffer from high post-harvest losses exceeding to 20-25%. Hence, there is a huge scope for converting this nutritious fruit into various commercial products, including pulp, paste, canned slices in syrup, RTS, nectar and juice. Among these products, guava juice has become economically important in the market. The consumption of tropical fruit juice like guava is currently growing (@10-15% annually) since it is natural, rich in nutrients and used as an alternative to

other antioxidant rich beverages such as soft drinks, tea and coffee.

The coloured grapes, especially teinturier types (Pusa Navrang, Manjari Medika etc.) are the excellent source of natural pigments. Both anthocyanins and phenols present in grapes are the promising antioxidants. These antioxidants have excellent therapeutic properties and can prevent or reduce the incidence of health



Fruits of guava cv. Allahabad Safeda

diseases or lifestyle disorders like Parkinson's disease, hypertensive cerebra-vascular injury, cataract genesis, ocular hemorrhage, atherosclerosis, various types of cancers, gastro-intestinal disorders, hypoxia, disorders related to alcoholism and ultimately ageing. Both guava and grapes have limited shelf-life due to their perishable nature; thus require immediate processing to avoid post-harvest losses. Therefore, it is necessary to utilize these fruits for making different products to increase their availability over an extended period and also to stabilize the prices during the glut season due to high entrepreneurial opportunities.

Coloured grape juice is inexpensive and has safest anthocyanins in abundance and relatively for colouring/ blending of food and beverage products doing away with harmful artificial colourants. Therefore, blending of two or more fruit juices and their mixed beverages are a convenient alternative for their utilization in order to have some health promoting value-added fruit drinks. The present technology proposed deals with preparation of blended fruit juices in the form of nectar. The pulps from ripe guava and juice extracted from coloured grapes were used for preparation of anthocyanin-enriched guava nectar, having a blend of guava and grape pulp juice (50:50 ratio).

Nutritional value of fruit crop based drinks

Fruit beverages are increasingly gaining popularity throughout the world due to nutritive and therapeutic values over synthetic beverages, as synthetic drinks contain only water (about 88%), carbohydrates (about 12%) and provide about 48 Kcal. Thus, fruit-based beverages are far more superior to many synthetic drinks. If synthetic drinks are replaced by fruit beverages, it would be a boon to the consumers as well as to the fruit growers. Moreover, fruit pulps and drinks have great export potential.

Fruit varieties used

Guava cv. Allahabad Safeda: It is the well-known variety grown in Uttar Pradesh for table use. The fruits are medium in size (180 g), round, and have few seeds. It exists to serve as both a table and for processing purposes. The fruit of this variety is round and medium sized (150-250 g) and heavy bearer which gives higher yield as compared to other varieties. The fruit's skin is very mild, and the flesh is white with few seeds and has excellent eating quality. This variety is cultivated in almost all the states and thus is available in abundance.

Coloured grape cv. Pusa Navrang: This hybrid is cross between (Madeleine Angevine × Rubired) and released for commercial cultivation in 1996 from IARI, New Delhi. It is a basal bearer and teinturier variety with red pigment in both the peel and pulp having distinct colouration. Its ripens in the 1st week of June. The bunch is loose and medium in size, with round and medium sized berries and has good TSS (18-20°Brix) (Table 1). It is resistant to anthracnose disease and is ideal for making coloured juice and wine. Furthermore, its berries have an edible portion of 90%, along with 80% juice and 17% total soluble solids. Its juice can be used as a colour additive in fruit and vegetable juices, as well as in blending with

juice of white grape varieties. This variety is suitable for commercial cultivation in the states of Jammu & Kashmir, Uttar Pradesh, Uttarakhand, Haryana, Himachal Pradesh, Punjab, Rajasthan, Chhattisgarh, Madhya Pradesh, Mizoram and Nagaland.



Bunch of coloured grape cv. Pusa Navrang

Table 1. Physico-chemical composition of guava and grape

Parameter	Fruit	
	Guava (Allahabad Safeda)	Grape (Pusa Navrang)
Juice/ pulp recovery (%)	55	68
Moisture (%)	80	87
TSS (°Brix)	9.5	18
Titrateable acidity (%)	0.30	0.35
Reducing sugars (%)	2.90	7.30
Total sugars (%)	4.6	8.2
Ascorbic acid (mg/100 g)	291	8.0
Total monomeric anthocyanins (mg /100 ml)	-	40.2

Preparation of anthocyanin enriched nectar

Nectar is a type of fruit beverage that contains at least 20% fruit juice/pulp and 15% total soluble solids and also about 0.3% acid. However, it is not diluted before serving. Guava (cv. Allahabad Safeda) fruits were harvested at the physiologically mature ripe stage, devoid of any blemishes, i.e. free from insect pests, diseases and mechanical damages; however its uniform fruits were quickly transported in CFB boxes to processing laboratory for extraction of pulp within 24 hours. The fruits were properly washed in running tap water, and after treatment the fruits were cut into halves using stainless steel knife and the seeds were removed and the juice was extracted using fruit pulper (Bajaj Process Pack Limited, Fruit Processing and Packaging Tech., Noida, Uttar Pradesh). Grape berries were selected having uniform bunch and free from insect pests and fungal diseases infection. The

berries were separated from rachis and quickly transported in CFB boxes to processing laboratory. The fruits were properly washed in running tap water, and thereafter juice was extracted using fruit pulper (500-4000 Ib\In2 Johnston Automation Co. Kirti Nagar, New Delhi). The extracted juice was sieved using muslin cloth to remove the seeds and peel. However, extracted juices of both the fruits were blended with defined proportion of 60:40, 50:50 and 40:60 (Guava: Coloured grape). The combination having 50:50 proportion was found to maintain good amount of nutrition as compared to other blend proportions (Table 2).

Table 2. Nutritional quality of blended beverages of guava and grape

Parameter	60:40 (G:CG)	50:50 (G:CG)	40:60 (G:CG)
TSS (°Brix)	12.25	14.35	13.50
Acidity (%)	0.40	0.45	0.41
Ascorbic acid (mg/100 g)	160.0	155.00	33.15
Anthocyanin (mg/100 ml)	12.30	25.25	26.25
Reducing sugar (%)	4.10	5.60	5.40
Total sugars (%)	9.60	11.20	10.50
Colour	8.2	8.5	8.1
Flavour	8.2	8.4	8.0
Taste	8.1	8.5	8.0
Overall quality	8.0	8.6	7.8

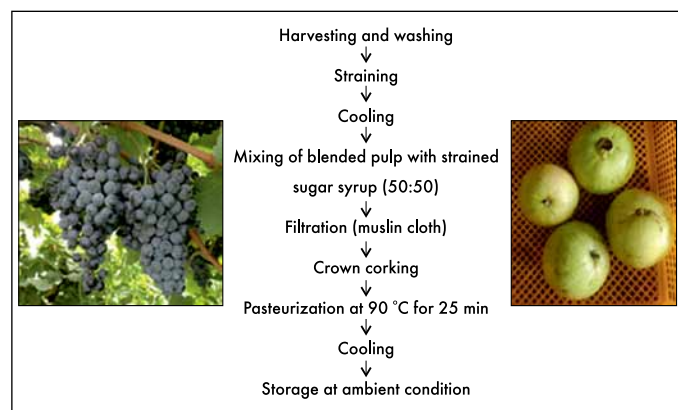
(G: Guava, CG: Coloured grape)

Packaging and storage

Blended nectars were packed in airtight transparent glass bottles (250 ml) and amber bottles (250 ml) under hygienic conditions and stored for four months at both ambient (25-27 °C) and low temperature (4-7°C) conditions without much loss in the nutritive value and were having the safe microbial counts. The storage under normal refrigeration conditions maintained the quality up to 6 months without much loss in nutritional quality.

Economics of production

For a medium scale processing laboratory, the cost:



Processing flow-sheet for blended nectar of guava and grape



Storage at (A) ambient condition and (B) at low temperature (4-7 °C)

benefit ratio of blended nectar of guava and grape (50:50) was estimated at 1:25, which was most superior to the synthetic drinks available in market at higher price. The cost of production of the 200 ml drink PET bottle, label and CFB boxes was estimated at ₹ 12.50. The natural drinks of guava and grapes, individually, have poor self-life, and the blending of these fruits as nectar enhances self-life; and fetches a good price when sold at ₹ 20 to 25 per bottle.

Ingredient	Quantity	Price/kg (₹)	Price for required quantity (₹)
Pulp	200 ml	50 Guava and 200 Grapes	5 Guava and 20 Grapes
Sugar	130 g	40	4.0
Citric acid	2.40 g	50	0.12
Water	667.60 ml	10	6.67

Total price (₹)	Selling price (₹)	Gross income (₹)	Net income (₹)	Cost: benefit ratio
36	45	45	9	1:25

Scope and future prospects

The present study showed that ideal blended (guava + coloured grape) nectar can be prepared as anthocyanin enriched guava nectar. It had appealing colour and taste and maintained the quality up to four to six months for human consumption. The blended drinks have high nutritional value and can ideally replace the artificial beverages that have earned a bad reputation as a result of their harmful effect of artificial additives/ sugars on human well-being. Since, the demand for nectar and RTS drinks devoid of preservatives is rising, the above technology developed can be a remunerative entrepreneurial venture for youths and women SHGs.

For further information please write to:

Ajit Kumar Singh (Research Scholar), Division of Food Science and Postharvest Technology, ICAR-Indian Agricultural Research Institute, New Delhi 110 012. *Corresponding author e-mail: 718713ajit@gmail.com