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Short communication

Antioxidant composition of guava (*Psidium guajava* L.) beverage blended with black-carrot juice

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ABSTRACT

An investigation was undertaken to study guava beverage blended with black-carrot juice, during 2011-2012. Enzyme-assisted processing of guava significantly improved the juice yield, total soluble solids, titratable acidity pH, ascorbic acid and sugars by using pectinase enzyme. The blending of guava beverage with black carrot juice significantly improved the functional properties of the guava RTS. Anthocyanin and ascorbic contents of blended guava RTS with black-carrot juice decreased with advancement of storage condition and period.

Key words: Guava, enzyme-assisted processing, functional quality, black carrot

Guava (*Psidium guajava* L.) is known as the apple of the tropics and is grown throughout the tropical and subtropical regions of India. It is a rich source of Vitamin C and minerals, viz., calcium, phosphorus and iron, necessary for human health. The guava fruit, and its juice, is popularly consumed for its great taste, nutritional benefits and nutrient content. Clarified guava juice is more acceptable and is used in the manufacture of clear guava-nectar or jelly, guava powder, or mixed-fruit juice blend. However, extraction of juice from guava is difficult and protracted owing to the gritty texture of its pulp and its pectineous nature. Enzyme-assisted processing with pectinolytic enzymes is an effective approach for degrading the pectinaceous material, to yield a free-flowing juice. Several researchers have reported recently that pectinase and cellulase enzyme treatments can significantly enhance recovery of phenolics and improve its functional properties (Collin *et al,* 1998). Black carrot has been in the focus as a source of natural food colorants (Collins *et al,* 1998), and high content of its anthocyanin pigments is being used for blending it with guava juice. Considering the enormous potential of guava as a source of phenolics, the objective of the current study was to study the effect of enzyme-assisted processing and blending of guava RTS with black-carrot juice, and to evaluate its functionality for imparting color appeal and antioxidant activity.

The present study was carried out for preparation of clarified guava juice using pectianase enzyme, and to utilize it for preparation of guava RTS (Ready-To-Serve juice) blended with black-carrot juice. Fully mature, ripe guava fruits (cv. L-49) free from blemishes and mechanical injury were procured from the local market. The location of the study was Department of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. Fruits of guava were washed thoroughly in tap water and cut into thin slices using a stainless-steel knife, and subjected to hot-breaking at 80^{o}C for 20 min, for softening the fruit pieces. These were subsequently passed through a laboratory-scale pulper for extracting a homogeneous pulp without seeds. Pulp samples were weighed out in 500ml glass bottles and the enzyme preparation (pectinase EC 3.2.1.1 from *Aspergillus niger*, 1 U/mg from *Aspergillus sp*.) was added at four concentrations: 0.5, 1, 1.5 and 2% E/S. Control (straight-pressed) pulp samples were incubated without the enzyme under the same conditions. For each concentration, 500ml of the pulp was taken in three replicates for analysis. The bottles were capped and incubated at 50^{o}C in a thermostatically controlled water-bath for 1 hour. The pulp was then pressed using a hydraulic press with a nylon filter-bag to extract the juice. The filtrate was centrifuged at 5000rpm for 10 min to obtain the clarified juice (whose yield was determined by weighing the juice extracted, subsequently heat-processing it at 90^{o}C for 1 min, and packing it in clean, sterilized glass-bottles finally upturned and sealed). The clarified juice was then used for preparation of guava RTS by adding sugar and water. The RTS was standardized by conducting preliminary trials with the juice; TSS, acidity and more combinations were used for preparing the RTS beverage. RTS was blended with black-carrot juice at 5%, 10%, 15% or 20% concentrations. The blended RTS was heated at 90°C for 1 min, and packed in clean and sterilized bottles, upturned, sealed and stored under ambient conditions or at 7°C for use in analysis. Anthocyanin content was determined by pH differential method (Spectrophotometeric method) described by (Wrolstad *et al*, 2005). Each experimental unit was replicated thrice. Data were subjected to Analysis of Variance, using Completely Randomized Design.

Physico-chemical composition of guava fruit and pulp

Data presented in Table 1 reveal fresh guava fruit as recording 10% TSS, 4.1 pH, 0.54% titrable acidity, 200.5 mg/100g ascorbic acid, 10.6% total sugars, 6.23% reducing sugars, and 4.37% non-reducing sugars; whereas, guava pulp recorded 9% TSS, 4.1pH, 0.64% titrable acidity, 198.7mg/100 ml ascorbic acid, 4.21% reducing sugars, 1.37% non-reducing sugar, and 5.58% total sugars. Results on total acidity, total soluble solids, pH, ascorbic acid and sugar content in guava are in agreement with earlier findings of Kumar and Honda (1994), Chatterjee *et al* (1992), Tondon and Kalra (1984), Tiwari (2000), and Gowda (1995).

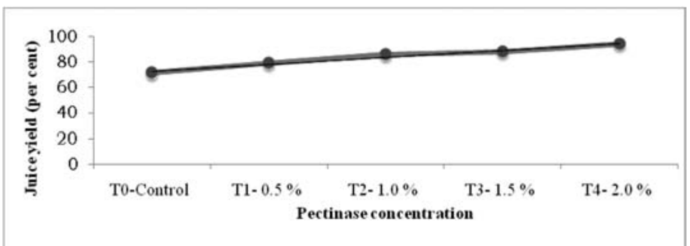

Fig. 1. Effect of pectinase concentration on juice yield in guava

Table 1. Physico-chemical composition of guava fruit

Traits	Fresh fruit	Fruit Pulp
TSS (%)	10.0	9.0
pH	4.10	4.1
Titrable acidity (%)	0.54	0.64
Ascorbic acid (mg/100g)	200.5	198.7
Reducing sugars (%)	6.23	4.21
Non-reducing sugars (%)	4.37	1.37
Total sugars (%)	10.60	5.58

Effect of enzyme-assisted processing on juice yield in guava

Data on effect of pectinase enzyme in varying concentrations (0.5%, 1.0%, 1.5% or 2.0%) for liquefication of guava juice, and enzymatically obtained clarified juice, compared to the juice in Control (without enzyme) as per cent juice-yield, are presented in Fig. 1. Significant increase in juice-yield was seen in enzyme-assisted processing. Juice yield in the Control sample T_0 was 71.3%, while, with increasing concentration of pectinase enzyme, the juice-yield increased to 94% in treatment T_4, followed by that in T_3 (88%), T_2 (85.80%) and T_1 (79%). Overall, 22.7% increase in juice-yield was seen as a result of degradation pectinase catalyzed in the plant cell-wall matrix. These results confirm the findings of Tiwari (2000) in guava.

Effect of enzyme-assisted processing on physic-chemical composition of guava juice

Data presented in Table 2 reveal that maximum TSS percentage (12.5), pH (4.66), titrable acidity (0.72), ascorbic acid content (25.15 mg/100g) and sugar content were recorded in treatment T_4, over the Control. Physico-chemical composition of the juice, viz., total soluble solids, pH, titrable acidity, total sugars, reducing sugars, non-reducing sugars and ascorbic acid content increased with pectinase concentration over the Control (untreated).

Physio-chemical composition of guava RTS blended with black-carrot juice

Data presented in Table 3 reveal that TSS of blended guava RTS ranged from 11.10% to 12.03%. Lowest value (11.10%) of TSS was recorded in treatment (T_4)

Table 2. Effect of enzyme-assisted processing on physico-chemical composition of guava juice

Treatment	TSS (%)	pH	Titrable acidity(%)	Ascorbic acid (mg/100g)	Sugars (%)		
					Reducing	Non-reducing	Total
T_1 (0.5%)	9.40	4.06	0.65	20.02	4.23	1.37	5.60
T_2 (1.0%)	11.00	4.36	0.67	22.36	4.23	1.38	5.61
T_3 (1.5%)	12.00	4.50	0.70	24.94	4.25	1.40	5.66
T_4 (2.0%)	12.50	4.66	0.72	25.15	4.26	1.42	5.68
T_0 (Control)	9.00	3.80	0.64	19.86	4.22	1.36	5.58
SE m+	0.05	0.12	0.004	0.33	0.005	0.003	0.012
CD *(p=0.05)*	0.16	0.37	0.015	1.05	0.018	0.012	0.038

Table 3. Physico-chemical composition of guava RTS blended with black-carrot juice

Treatment	TSS (%)	pH	Titrable acidity (%)	Ascorbic acid (mg/100ml)	Anthocyanin (mg/l)	Sugars (%)		
						Reducing	Non-reducing	Total
T_1 (5%)	11.86	5.51	0.31	9.52	20.91	2.56	8.23	10.79
T_2 (10%)	11.73	5.31	0.28	9.31	24.44	2.55	8.19	10.74
T_3 (15%)	11.60	5.11	0.26	9.01	26.45	2.53	8.18	10.71
T_4 (20%)	11.10	4.90	0.25	8.81	29.83	2.52	8.15	10.66
T_0 (Control)	12.03	5.73	0.32	9.76	-	2.57	8.31	10.88
SE m+	0.005	0.005	0.005	0.005	0.003	0.005	0.006	0.005
CD *(p=0.05)*	0.018	0.018	0.018	0.018	0.011	0.016	0.019	0.018

Table 4. Sensory evaluation of guava RTS blended with black-carrot juice (Scale 0-9)

Treatment	Colour	Consistency	Flavour	Aroma	Overall acceptability (Scale 0-9)
T_1 (5%)	8.25	8.41	7.41	7.41	7.86
T_2 (10%)	7.37	7.44	7.32	7.00	7.28
T_3 (15%)	7.30	7.30	6.85	7.11	7.06
T_4 (20%)	7.20	7.21	7.20	6.93	7.18
T_0 (Control)	6.07	6.29	7.06	7.31	6.66
SE m+	0.003	0.005	0.005	0.015	0.005
CD *(p=0.05)*	0.014	0.017	0.016	0.048	0.18

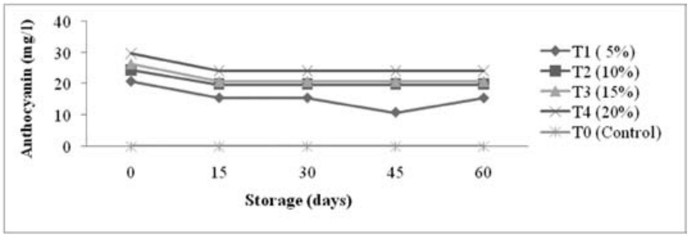

Fig. 2. Effect of storage conditions on anthocyanin content guava RTS blended with black-carrot juice at ambient temperature

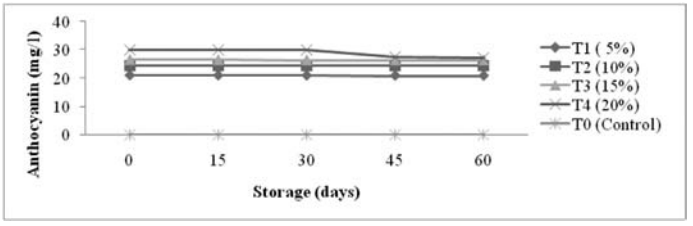

Fig. 3. Effect of storage conditions on anthocyanin content in guava RTS blended with black-carrot juice at 7°C

guava RTS blended with 20% black-carrot juice, compared to the T_0 Control (12.03%). Highest titrable acidity was recorded in the Control (0.32%) guava RTS, while the lowest was recorded in treatment (T_4) guava blended RTS with 20% black carrot juice (0.25). Highest ascorbic acid content was recorded in the Control treatment T_0 (9.76mg/100 ml), whereas, the lowest ascorbic acid content was recorded in guava RTS blended with 20% black-carrot juice (8.81mg/ 100 ml). A similar trend was observed in total sugar content, reducing sugars and non-reducing sugars in guava RTS blended with black-carrot juice.

The highest total anthocyanin content was recorded in treatment (T_4) guava RTS blended with 20% black-carrot juice, followed by treatment (T_3) that blended with 15% black-carrot juice, (T_2) 10% black-carrot juice and (T_1) 5% black-carrot juice, in that order. These results are in agreement with Bhuvaneshwari and Doreyappa Gowda (2006), and Garymain *et al* (2001).

Sensory analysis of guava RTS blended with black-carrot juice

Blending guava RTS with black-carrot juice improved organoleptic quality remarkably in guava juice blended with 5 or 10% black-carrot juice (Table 4). The highest colour score (8.25), consistency score (8.41), flavour score (7.41), aroma score (7.41) and overall acceptability score (7.86) was recorded in treatment (T_1) fallowed by in treatment T_2, while lowest colour (6.07), consistency (6.29), flavor (7.06), aroma (7.31) and overall acceptability (6.66) score was recorded in treatment (T_0). The product developed had a preponderant flavor of the original fruit used, lack of the earthy, raw flavor or added phytochemical content. The products show a good potential for anthocyanin-rich, healthy drinks for the food industry looking for natural alternatives to synthetic drinks. Results obtained by us are in agreement with Bhuvaneshwari and Doreyappa Gowda (2006).

Storage of guava RTS blended with black-carrot juice

Total anthocyanin content

Data on anthocyanins in guava RTS blended with black-carrot juice at room temperature and at 7°C are presented in Figs. 2 and 3. Anthocyanin content of guava RTS blended with black-carrot juice was found to decrease with advancing storage period, irrespective of the storage conditions. Initially, the highest value (29.85 ml/ l) for anthocyanin was recorded in treatment (T_4) 20% black-carrot juice blended with guava RTS. No anthocyanin content was found treatment (T_0) in the Control guava RTS.

Similar trend was observed in 15, 30 or 45 days stored guava RTS blended with black-carrot juice, at room temperature. At 60 days, the highest value (24.20ml/ l) for anthocyanin content was recorded in treatment (T_4) 20% guava RTS blended with black-carrot juice at 7^{o}C. Total anthocyanin content during storage at different temperatures decreased in comparison to non-stored juice. These results are in agreement with Alighourchi and Barzegar (2009).

Results indicated that use of enzymes for liquefaction prior to pressing can improve the quality of guava juice remarkably, culminating in enhanced juice-yield. Blend of guava RTS with black-carrot juice enhanced anthocyanin content in the juice, which is directly related to health-promoting capacity; it also contained high anthocyanin content, with a stable and attractive strawberry-red colour. Blending of guava with black-carrot juice in the preparation of RTS beverage resulted in a product with good organoleptic (colour) properties and can be used as a health-drink.

REFERENCES

Alighourchi, H. and Barzegar M. 2009. Some physicochemical characteristics and degradation kinetics of anthocyanin of reconstituted pomegranate juice during storage. *J. Food Engg.*, **90**:179-185

Bhuvaneswari, S. and Doreyappa Gowda, I.N. 2006. Small-scale processing of blended grape RTS. *Beverages Food World J.,* **33:**72-72

Chatterjee, D., Singh, U.P., Thakur, S. and Kumar, R. 1992. A note on the bearing habits of guava (*Psidium guajava* L.). *Haryana J. Hortl. Sci*., **21**:69-71

Collins, P., Plumbly, J. and Stich, E. 1998. Black carrots-established raw materials for the manufacture of Carantho food color and Exberry vegetable juice color: stability and application. 3rd Intl. Symp. Natl. Colorants, Hamden, SIC, Hamden. Pp 107-120

Garymain, Mike Faupel, Justin Morries and Ronald Mcnew. 2001. Quality and stability of blueberry juice blended with apple, grape and cranberry juice. *J. Food Qual.*, **24**:111-125

Gowda, I.N.D. 1995. Studies on blending of mango and papaya pulp for ready-to-serve beverage making. Proceedings of National Seminar on Post-harvest Technology of Fruits, Bengaluru, August 07-09, 1995, pp. 387-494

Kumar, R. and Honda, M.N. 1994. Fixtation of maturity standard of guava (*Psidium guajava* L.). *Indian J. Hortl. Sci*., **31**:140-144

Tiwari, R.B. 2000. Studies on blending of guava and papaya pulp for RTS beverage. *Indian Food Packer*, **54**:68-72

Tondon, D.K. and Kalra, S.K. 1984. Chemical evaluation of stored guava pulp in polyethylene pouches. *Indian Food Packer*, pp **38:**57-59

Wrolstad, R.E., Durst, R.W. and Lee, J. 2005. Tracking colour and pigment changes in anthocyanin products. *Trends Food Sci. Technol.,* **16**:423-428

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