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Suitability of newly evolved antioxidant rich grape cultivars for processing into juice and beverages

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ABSTRACT

Four grape cultivars, *i.e.* Portan, Chasan-B, H-516 and Muscat Hamburg were processed into juice, nectar and ready-to-serve beverage. Among the four cultivars, H-516 was found to have the maximum total soluble solids (19.67 °B), maximum ascorbic acid (8.13 mg/ 100g), maximum specific gravity (1.0886), good juice yield (62.38%) and maximum anthocyanins (5.47 mg/100g). Organoleptically, juice from cultivar H-516 was found to have the maximum overall acceptability scores (8.92), followed by Chasan-B (8.25), Portan (8.13) and Muscat Hamburg (8.25) on a 9-point hedonic scale by a panel of eight semi-trained judges. Nectar and ready-to-serve beverage prepared from these grape cultivars also scored highest for H-516 cultivar. Even after twelve months storage juice from cultivar H-516 was scored highest in its overall acceptance (8.63), taste (8.50) and colour (8.88) by a panel of eight judges on a 9-point hedonic scale.

Key words: Grape, juice, nectar, ready-to-serve beverage, quality.

INTRODUCTION

India is emerging as a major producer and exporter of grapes in the world. India produces 15.46 lakh tonnes of grapes annually, of which about 20,000-25,000 tonnes are exported (NHB, 4). Punjab follows Maharashtra and Karnataka in production of grapes with 32.0 thousand metric tonnes of (Anon, 2) production. India's exports of fresh grapes fell from 23,680 tonnes to 14.571 tonnes valued at Rs. 59.96 crores in 2001-02 due to its major competitor China, therefore, exports dropped Bangladesh & UK. For exports to UK, each bunch of grapes should weigh between 300 to 600 g. All the berries should be of uniform size and at least 18 mm in diameter (Sandhu *et al.,* 6). The grapes should not contain more pesticide residues than the acceptable limits. Fruit is not only perishable but also quite vulnerable, delicate and prone to injuries. With in one or two days of harvesting, it starts fermenting at ambient room temperature, since it comes in hot months from May to July (Singhal, 7). There arises a need for processing this produce into more stable forms. Hence, this study was undertaken with the objective to analyse the suitability of new grape hybrids for processing into juice and beverages.

MATERIALS AND METHODS

Bulk lots of grape hybrids, *i.e.* Portan, Chasan-B, H-516 and Muscat Hamburg were obtained from Punjab Agricultural University Research Orchards and graded to remove trash and extraneous matter. The grapes were destalked, sorted for sound berries and washed. Berries were first crushed and heated for the complete extraction of colour from the peel and then this crushed mass was extracted by a superfine pulper into juice which was filtered through muslin cloth and pasteurized at 85°C for 3 min. The juice was filled into glass bottles (650 ml) and processed in boiling water for 20 min. The bottles were cooled immediately and kept for storage at room temperature. Recipe for nectar was standardized with 40% juice and 15% total soluble solids and 0.32% acid on the basis of sensory evaluation by a panel of semi-trained judges keeping in view the minimum standards given by FPO. Pasteurized nectar was hot filled into glass bottles of capacity 200 ml. Bottles were then processed in boiling water for 20 min. The bottles were cooled and kept for storage at ambient room temperature.

Beverage was prepared with 15% juice, 12% total soluble solids and 0.28% acid on the basis of sensory evaluation by a panel of semi-trained judges keeping in view the minimum standards given by FPO. It was pasteurized, filled hot into glass bottles. Processed in boiling water for 20 min., cooled and kept for storage at ambient room temperature. The average cluster weight, yield/ vine, berry weight of each variety were recorded. The total solids (TS), total soluble solids (TSS), titrable acidity, pH, ascorbic acid, anthocyanins and specific gravity were determined (5). The juice, nectar and ready-to-serve beverage were prepared from different grape

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hybrids and then evaluated for colour, flavour, body and overall acceptability by a panel of eight semi-trained judges on a 9-point hedonic scale (Amerine *et al.*, 1). The effect of storage on organoleptic quality of juice, nectar and ready-to-serve beverage under ambient temperature (35°-15°C) was studied over a period of twelve months. All the samples, (Amerine *et al.*, 1), *i.e.* juice, nectar and ready-to-serve beverage prepared from the best genotype H-516 were also analysed by general consumers for their judgment on a simple scale of excellent to poor. Results were analysed statistically for their interpretation using completely randomized design experiment (Cochran and Cox, 3).

RESULTS AND DISCUSSION

Physico-chemical characteristics of grape clusters of newly grown cultivars are given in Table 1. Among the four cultivars, Muscat Hamburg was found to have maximum cluster weight (268.27 g) and berry weight (1.98 g). Cultivar H-516 had the deepest colour, maximum TSS (17.73 °B) and minimum acidity (0.45%). Cultivar H-516 gave the maximum yield (13.07 kg/vine). Juice yield was maximum of Muscat Hamburg (76.8%) followed by Portan (64.67%), H-516 (62.38%) and Chasan-B (62.2%). Juice from cultivar H-516 was found to have maximum total soluble solid (19.67°B), ascorbic acid (8.13 mg/100 g), anthocyanins (5.47 mg/100 g), specific gravity (1.08) and deepest and brightest purplish-red colour (Table 2).

Organoleptically juice from all the cultivars was found acceptable (Table 4). Cultivar H-516 was found the best for its colour, flavour and overall acceptability with 9.00, 8.88, 8.88, 8.92 scores respectively. Chasan-B was good in colour, but not as flavourful as H-516. Muscat Hamburg scored was good in flavour (8.50) scores, but moderately acceptable for its colour (7.75). Portan was good in colour (8.50) but moderate in its aroma and taste (7.38). Nectar prepared from H-516 cultivar was found to have maximum scores for colour (8.75), flavour (8.79), body (8.5) and overall acceptance (8.63). No significant difference ($p \leq 0.05$) was found in the body of nectar of the four cultivars. Significant difference ($p \leq 0.05$) in the colour grapes and flavour of RTS beverage prepared from different varieties was noted (Tables 4-6).

Effect of storage on physico-chemical characteristics of processed grape juice from new cultivars was non-significant (Table 3) except for ascorbic acid which was found to decrease during storage and processing. Decrease in ascorbic acid during hot processing of grape was also reported by Sandhu *et al.* (6). There was not much effect of storage on the sensory quality of grape juice during storage. Nectar prepared from different grape cultivars were found acceptable after six months of storage (Table 5). Storage had no significant effect on the colours, flavour, body and over acceptance of the juice, nectar and ready-to-serve beverage prepared from different grape cultivars (Tables 4-6). Samples of juice, nectar and ready-to-serve beverage were served to 200 general consumers to judge their preferences for the products. Juice was rated exellent by 43,75%, very good by 31.25% and good by 12.5% and fair by 11.60% consumers. None of the consumers rated juice and nectar as a poor drink (Fig. 1). About 28 and 31% consumers rated RTS and nectar as excellent drinks,

Table 1. Physico-chemical characteristics of some grape cultivars.

Cultivar	Year of harvesting	Ripening time	Cluster wt. (g)	Yield/ vine (kg)	Berry wt. (g)	TSS (°Brix)	Acidity (%)
Portan	2004	25th May	140.0	4.2	1.18	17.1	0.58
	2005	7 June	154.8	6.0	-	16.1	0.61
	2006	9th June	201.6	8.4	-	16.2	0.58
Chasan-B	2004	26th May	122.0	4.6	1.26	16.2	0.72
	2005	7th June	121.4	5.6	-	16.3	0.69
	2006	7th June	175.2	9.2	-	17.0	0.61
H-516	2004	7th June	172.0	11.5	1.71	17.1	0.51
	2005	7th June	191.2	13.9	-	18.1	0.48
	2006	10th June	220.1	13.8	-	18.0	0.53
Muscat	2004	22th June	205.0	10.2	1.98	15.0	0.78
Hamburg	2005	7th July	308.8	12.4	-	15.9	0.43
	2006	6th July	291.0	11.7	-	15.6	0.56

*Average of three replications.

Table 2. Physico-chemical analysis of grape juice of different grape cultivars.

Cultivar	Year	Juice yield (%)	TSS (°B)	Acidity (%)	PH	Ascorbic acid (mg/100 g)	Specific gravity	Anthocyanins (mg/100 g)
Portan	2004	68.10	14.00	0.59	3.75	2.50	1.062	4.80
	2005	64.90	15.40	0.56	3.80	3.50	1.073	5.30
	2006	61.00	14.80	0.57	3.80	3.89	1.065	5.00
	Mean	64.67	14.73	0.58	3.79	3.29	1.067	5.03
Chasan-B	2004	68.40	16.00	0.57	3.84	2.56	1.070	5.24
	2005	56.40	17.60	0.58	3.80	3.76	1.071	5.40
	2006	61.80	19.20	0.51	3.90	3.06	1.073	5.18
	Mean	62.20	17.60	0.56	3.84	3.13	1.071	5.27
H-516	2004	60.50	19.50	0.59	4.08	8.34	1.088	5.50
	2005	61.34	20.00	0.59	3.92	8.06	1.088	5.60
	2006	65.30	19.59	0.62	3.98	7.99	1.088	5.30
	Mean	62.38	19.67	0.60	3.99	8.13	1.088	5.47
Muscat	2004	76.50	18.00	0.65	4.24	4.75	1.081	2.30
Hamburg	2005	76.90	17.40	0.56	4.20	6.75	1.082	2.45
	2006	77.00	18.60	0.53	4.00	5.73	1.082	2.28
	Mean	76.80	18.00	0.58	4.18	5.74	1.081	2.34

*Average of three resplications.

Table 3. Effect of storage and processing on the physico-chemical characteristics of natural juice from grape cultivars.

Cultivar	Duration (month)	TSS (°B)	Acidity (%)	pH	Ascorbic acid (mg/100 g)	Specific gravity
Portan	0	14.73	0.58	3.79	3.29	1.067
	3	14.72	0.56	3.80	2.80	1.067
	6	14.75	0.57	3.75	2.35	1.067
	12	14.70	0.56	3.72	1.86	1.067
	Mean	-	-	-	-	-
Chasan-B	0	17.6	0.56	3.84	3.13	1.071
	3	17.8	0.57	3.82	2.72	1.071
	6	17.6	0.55	3.80	2.20	1.071
	12	17.7	0.57	3.82	1.80	1.071
	Mean	-	-	-	-	-
H-516	0	19.67	0.60	3.99	8.13	1.088
	3	19.68	0.62	3.98	7.73	1.088
	6	19.65	0.61	3.97	6.50	1.088
	12	19.66	0.59	4.00	4.58	1.088
	Mean	-	-	-	-	-
Muscat	0	18.00	0.58	4.18	5.74	1.081
Hamburg	3	18.10	0.56	4.00	4.37	1.082
	6	18.20	0.57	4.16	3.20	1.081
	12	18.00	0.59	4.12	2.79	1.081
	Mean	-	-	-	-	-

*Mean values of three years.

respectively. Cost of the products was calculated as 3.90, 3.30 and 2.80 Rupees per bottle respectively for juice, nectar and ready-to-serve beverage (Table 6).

Table 4. Effect of processing and storage on the organoleptic quality of grape juice.

Cultivar	Storage (month)	Colour	Flavour	Body	Overall mean
Portan	0	8.50	7.38	8.50	8.13
	3	8.38	7.25	8.50	8.04
	6	8.25	7.00	8.63	7.96
	12	8.25	6.63	8.25	7.71
	Mean	8.35	7.06	8.47	7.96
Chasan-B	0	8.63	7.50	8.63	8.25
	3	8.50	7.38	8.75	8.21
	6	8.50	7.25	8.50	8.08
	12	8.75	7.00	8.50	8.08
	Mean	8.60	7.28	8.60	8.16
H-516	0	9.0	8.88	8.88	8.92
	3	9.0	8.75	8.75	8.83
	6	8.8	8.63	8.50	8.67
	12	8.8	8.50	8.50	8.63
	Mean	8.94	8.69	8.66	8.76
Muscat Hamburg	0	7.75	8.50	8.50	8.25
	3	7.63	8.25	8.63	8.17
	6	7.50	8.38	8.38	8.09
	12	7.50	8.25	8.38	8.04
	Mean	7.60	8.35	8.47	8.14
CD at 5%		0.45	0.50	NS	0.27

*Mean scores of eight panelists.

Table 5. Effect of processing and storage on the organoleptic quality of nectar from different grape cultivars.

Cultivar	Storage (month)	Colour & appearance	Taste & aroma	Body	Overall acceptability
Portan	0	8.00	7.00	8.00	7.70
	3	8.25	6.75	8.25	7.75
	6	8.00	6.63	8.25	7.63
	12	8.38	6.50	8.00	7.63
	Mean	8.16	6.72	8.13	7.67
Chasan-B	0	8.50	7.25	8.25	8.00
	3	8.75	7.38	8.38	8.17
	6	8.63	7.25	8.25	8.04
	12	8.50	7.00	8.25	7.92
	Mean	8.60	7.21	8.28	8.03
H-516	0	8.75	8.75	8.50	8.67
	3	8.88	8.88	8.50	8.75
	6	8.63	8.75	8.63	8.67
	12	8.50	8.63	8.38	8.50
	Mean	8.69	8.75	8.50	8.65
Muscat Hamburg	0	7.75	8.50	8.38	8.21
	3	7.63	8.25	8.25	8.04
	6	7.50	8.00	8.25	7.92
	12	7.50	8.00	8.00	7.83
	Mean	7.60	8.19	8.22	8.00
CD at 5%		0.58	0.51	NS	0.32

*Mean scores of eight panelists.

Table 6. Effect of processing and storage on the organoleptic quality of ready-to-serve beverage from different grape cultivars.

Cultivar	Storage (month)	Colour & appearance	Taste & aroma	Body	Overall acceptability
Portan	0	7.75	6.75	7.38	7.29
	3	7.63	6.63	7.25	7.17
	6	7.50	6.50	7.25	7.08
	12	7.50	6.63	7.38	7.17
	Mean	7.60	6.63	7.32	7.18
Chasan-B	0	7.88	6.50	7.25	7.21
	3	7.63	6.63	7.38	7.21
	6	7.63	6.50	7.25	7.13
	12	7.75	6.50	7.25	7.17
	Mean	7.72	6.53	7.28	7.18
H-516	0	8.00	7.88	7.75	7.88
	3	7.88	7.88	7.50	7.75
	6	7.75	7.75	7.63	7.71
	12	7.63	7.63	7.50	7.59
	Mean	7.82	7.77	7.60	7.73
Muscat	0	6.88	7.88	7.88	7.46
Hamburg	3	6.75	7.75	7.75	7.42
	6	6.63	7.75	7.63	7.30
		6.50	7.50	7.50	7.17
	Mean	6.69	7.69	7.69	7.34
CD at 5%		0.58	0.51	NS	0.32

*Mean scores of eight panelists.

Table 7. Cost of different grape processed products (cost per bottle in Rs.).

Ingredient	Juice	Nectar	RTS beverage
Fruit	1.70	0.65	0.25
Sugar	0.20	0.60	0.50
Citric acid	-	0.05	0.05
Empty bottle (200 ml)	1.70	1.70	1.70
Processing charges including depreciation cost	0.30	0.30	0.30
Total	3.90	3.30	2.80

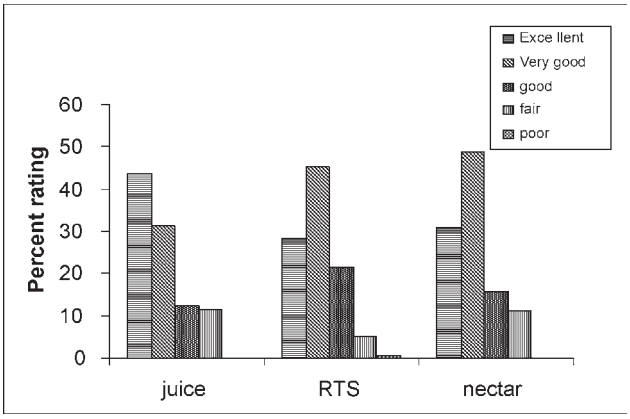

Fig. 1. Percent rating of general consumer acceptance for different grape juice processed drinks.

REFERENCES

1. Amerine, M.A., Pangborn, M. and Roessler, E.B. 1965. *Principles of Sensory Evaluation of Food*. Academic Press Inc., New York, USA, pp. 366-74.

2. Anony. 2007. District-wise area and production of different fruits in the Punjab state. Directorate of Horticulture, Government of Punjab, Chandigarh, India, 2007.

3. Cochran, W.G. and Cox, G.M. 1957. *Experimental Designs*, John Willey and Sons Inc. New York, pp. 95-100.

4. National Horticulture Board. 2004. *Horticulture Database*, Gurgaon, Haryana.

5. Ranganna, S. 1994. *Hand Book of Analysis and Quality Control for Fruit and Vegetable Products*. 2nd edn. Tata McGraw Hill Pub. Co. Ltd, New Delhi, India, 1112 p.

6. Sandhu, G.S., Bawa, A.S. and Bains, G.S. 1988. Studies on the effect of variety, processing and storage on the quality of grape juice. *Indian Fd. Packer* **4**: 36-42.

7. Singhal, V. 2003. Grapes. **In**: *Indian Agriculture*, pp. 239-43.

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