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Preparation of apple cider: Effect of apple juice concentration on physico-chemical composition and sensory qualities of apple cider

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Abstract

Apple (*Malus domestica* Borkh) is the most important temperate fruit crop cultivated widely in north – western Himalayan region and north – eastern region of India. It is extremely rich in important antioxidants, flavanoids, and dietary fibers. In the present study, the attempt was made to prepare apple cider from apple base wine and fresh apple juice. Apple base wine was blended with fresh apple juice in different concentrations viz. 90:10, 85:15, 80:20, 75:25, 70:30, 65:35, 60:40, 55:45 and 50:50. For preparing apple base wine, apple juice was ameliorated with sugar (20° B) and 100 ppm KMS then the apple must was fermented with strain of *Saccharomyces cerevisiae* (5% v/v) at 20 to 22°C. The fermentation was completed in four weeks at the time specific gravity of must was reached at 0.999. After fermentation the apple must was racked for clear and transparent apple base wine at 15 days of interval for three to four times. The prepared apple base wine was evaluated for different physico-chemical compositions viz. TSS (6.80° B), titratable acidity (0.39%), pH (3.08), total sugar (3.31%), sugar: acid ratio (8.44) and ascorbic acid (0.61 mg/100 ml). After that fresh apple juice was extracted and blended with apple base wine in different concentrations. As the per cent of added juice was increased titratable acidity of apple cider was decreased and TSS, pH, total sugars, sugar: acid ratio and ascorbic acid was increased. In the sensory quality evaluation, the apple cider made with apple juice 45%: apple base wine 45% (T₈) was rated as best followed by T₇ & T₉ and considered as best cider for consumption.

Keywords: Apple base wine, *Malus domestica*, cider, antioxidant, fermentation, ascorbic acid

Introduction

Apple (*Malus domestica* Borkh) is the most important temperate fruit. Apple's remedial value is also notable for various chronic illnesses. According to Laplace *et al.* (2001) [8], for more than 2000 year in the Eastern Mediterranean region, apple juice was fermented to obtain a pleasant alcoholic beverage. Presently apple juice is fermented to manufacture cider which is a sparkling and refreshing fruit flavoured beverage, consumed in many countries around the world (Alberti *et al.*, 2011, Joshi *et al.*, 2011a) [1, 7], along with wine and brandy. Apple possesses balanced amount of nutritive salts for yeast to naturally create a stable and drinkable beverage. Lea and Drilleau (2003) [9] reflect that tannins are an aggregation of polyphenols which provide astringency and bitterness to the cider and is essential for its high organoleptic attribute. It was a common drink at the time of Roman invasion of England in 55 BC, even more popular than beer in 11th and 12th centuries (Jarvis *et al.*, 1995) [4]. Cider could be hard or soft (Downing, 1989, Joshi, 1997) [2, 5] though it has been produced for over two millennia, the scientific aspects of the production are less documented than other similar beverages (Jarvis *et al.*, 1995) [4]. India produces a large quantity of apple and cider production could become an important tool for diversification and prevention of post harvest losses. In earlier published work, apple cider was prepared with blending of apple juice and apple base wine in different concentrations. However, there is no report on preparation of cider from apple and effect of apple juice concentrations on physico-chemical composition and sensory qualities of apple cider. Therefore, effort were made to prepare apple cider by blending apple juice and apple base wine in different concentrations and the results are presented in this communication.

Material and Methods

Optimum matured apple fruits were used for cider making. Fruits were washed, grated and extract the juice. Apple juice was used to produce apple base wine. For blending fresh apple juice was extracted later. To produce apple base wine apple juice was ameliorated with sugar accordingly leads to alcoholic fermentation. To initiate fermentation 24 hours culture of yeast strain *Saccharomyces cerevisiae* at the rate of 5% was used in the sterilized apple juice.

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It was carried out in 10 litres glass aspirator bottle equipped with air lock containing 5 litres of apple juice at a temperature of 20 to 22 °C. The must was also ameliorated with 100 ppm of KMS to control the growth of wild yeast strains. After completion of fermentation the wine was racked and used as a base wine. The initial TSS was kept at 20 °Brix. The fresh apple juice was extracted for blending with apple base wine in different concentrations such as 10, 15, 20, 25, 30, 35, 40, 45 and 50% v/v to analyse the effect of apple juice on sensory qualities. The final blended product was pasteurized at 85 to 90 °C for 20 minutes. After that product was analysed for TSS, acidity, pH, sugars, ascorbic acid, sugar: acid ratio, colour and sensory qualities.

The TSS was determined by hand refractometer and expressed as degree brix (°Brix). Acidity, pH, sugars and ascorbic acid were analysed as per standard methods (Ranganna, 1997) [11]. Sugar: acid ratio was calculated by dividing total sugar value with total acidity value. The sensory evaluation was carried out by a panel of 10 judges following the hedonic rating test (Ranganna, 1997) [11]. The data were statistically analysed with variance technique given by Gomez and Gomez (1985) [3].

Results and Discussion

Data on blending of apple base wine with apple juice are given in Table 1. There was a significant increase in the TSS of the wine, as the percentage of the added juice was increased. The trend was reversed in case of titratable acidity which registered a significant decrease over the base wine. A significant increase in pH of wine also took place as a result of blending with fresh juice and the increase was proportional to the amount of juice added. It is in consistence with the decrease in the acidity. But it remained within the acidic range. The low pH is useful from spoilage prevention point of view. The residual sugars (total, reducing and non-reducing sugar) of blended wines increased significantly compared to

the base wine. As expected, a significant increase in ascorbic acid of the blends compared to the base wine was recorded. A significant increase in sugar: acid ratio of the wine, as the percentage of the added juice was increased were observed. Blends with higher proportion of juice more than 20 per cent had low acidity and more TSS and high reducing sugar, and are thus, more suited as cider or wine (Joshi and Sandhu, 2000) [6].

The scores obtained for various sensory qualities are given in Table 2 The base wine (without blending) had lowest score for taste which increased with addition of increasing percentage of juice but these product did not score well as a good cider except the combination with more than 20 per cent of apple juice. It might partly due to the masking effect of sugar and partly due to the flavour of apple juice. The taste and flavour quality of cider are dependent upon composition of apple, industrial process used for juice extraction and fermentation process (Mangas *et al.*, 1993) [10]. Increase in sugar concentration increased the pleasantness and decreased the harshness of apple juice.

The trend for flavour reflected as increased score of blended product more than 25 per cent juice level enhance fruity flavour in apple cider. The high percentage juice might have decreased the cider flavour and increased apple flavour shifting more towards soft cider rather than hard. The primary characterization of cider is a spicy aromatic apple which occurs to a greater or lesser extent in all the cider. Thus, it differentiates the ciders from other fermented beverages (Jarvis *et al.*, 1995) [4]. The changes in the perceived flavour of the cider could partly be attributed to the enhanced apple flavour of juice and partly to the impact of the sugar of the juice added (Jarvis *et al.*, 1995) [4]. In all the sensory quality attributes, viz. colour, appearance, flavour & aroma, taste and overall quality, blend with 45 per cent juice was adjudged to be the best product as apple cider followed by blend with 40 and 50 per cent juice.

Table 1: Effect of juice concentration on composition of apple cider

Treatments	TSS (°Brix)	Acidity (%)	pH	Reducing Sugar (%)	Non-Reducing Sugar (%)	Total Sugar (%)	Sugar: Acid Ratio	Ascorbic Acid (mg/100 ml)
T ₀ Apple base wine	6.80	0.39	3.08	1.06	2.25	3.31	8.44	0.61
T ₁ Apple juice (10%) + Apple base wine (90%)	7.43	0.36	3.52	1.87	2.44	4.31	12.01	0.66
T ₂ Apple juice (15%) + Apple base wine (85%)	7.80	0.35	3.60	2.04	2.48	4.52	12.92	0.69
T ₃ Apple juice (20%) + Apple base wine (80%)	8.20	0.34	3.67	2.50	2.50	5.00	14.88	0.73
T ₄ Apple juice (25%) + Apple base wine (75%)	8.40	0.33	3.70	2.84	2.51	5.35	16.22	0.76
T ₅ Apple juice (30%) + Apple base wine (70%)	8.50	0.32	3.75	3.45	2.67	6.12	19.14	0.78
T ₆ Apple juice (35%) + Apple base wine (65%)	8.80	0.30	3.78	3.76	2.67	6.43	21.20	0.80
T ₇ Apple juice (40%) + Apple base wine (60%)	9.17	0.28	3.80	4.09	2.80	6.89	24.63	0.83
T ₈ Apple juice (45%) + Apple base wine (55%)	9.50	0.27	3.86	4.63	2.83	7.46	27.67	0.85
T ₉ Apple juice (50%) + Apple base wine (50%)	9.60	0.25	3.93	5.03	3.09	8.12	32.50	0.89
CD (p=0.05)	0.308	0.023	0.071	0.101	0.178	0.021	1.295	0.027

Conclusion

Apple cider prepared by blending different juice per cent with apple base wine and evaluated for physico-chemical and sensory analysis. Addition of increasing concentration of juice to the base wine increased TSS, pH, sugars, ascorbic acid and

sugar: acid ratio but titratable acidity was decreased. Addition of apple juice per cent enhance the colour and overall sensory quality but reduce the bitterness. Based on both physico-chemical and sensory analysis, a product with 45 per cent juice was adjudged as the best apple cider.

Table 2: Effect of juice concentration on sensory qualities of apple cider

	Treatments	Colour	Appearance	Flavour & Aroma	Taste	Overall Quality
T ₀	Apple base wine	6.1	6.1	5.4	5.7	5.8
T ₁	Apple juice (10%) + Apple base wine (90%)	6.1	5.6	5.7	5.8	5.8
T ₂	Apple juice (15%) + Apple base wine (85%)	6.1	6.1	6.1	5.9	6.1
T ₃	Apple juice (20%) + Apple base wine (80%)	6.5	6.4	6.4	5.8	6.3
T ₄	Apple juice (25%) + Apple base wine (75%)	6.2	6.2	6.3	5.8	6.1
T ₅	Apple juice (30%) + Apple base wine (70%)	6.2	6.2	5.6	6.1	6.0
T ₆	Apple juice (35%) + Apple base wine (65%)	6.1	6.2	5.7	6.1	6.0
T ₇	Apple juice (40%) + Apple base wine (60%)	6.7	6.6	6.4	6.8	6.6
T ₈	Apple juice (45%) + Apple base wine (55%)	7.3	7.2	7.1	7.1	7.2
T ₉	Apple juice (50%) + Apple base wine (50%)	6.3	6.2	6.7	7.1	6.6

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