

Effect of blending cashew apple (*Anacardium occidentale* L.) and aonla (*Emblica officinalis* Gaertn.) juice on fermentation of wine

Abstract

A Completely Randomized Design (CRD) was employed to assess nine different treatment combinations, varying in juice ratios and fermentation conditions. The study aimed to evaluate the effects of blending cashew apple and aonla juices on the quality and fermentation characteristics of the resulting wine. While studying the chemical composition of cashew apple and aonla juice, cashew apple juice had a maximum value for T.S.S., reducing sugars, total sugars and pH. Aonla aonla juice had a maximum value for titratable acidity, ascorbic acid and tannin content. The T.S.S. of must was adjusted to 24 °Brix and pH kept natural. The T.S.S. and pH was found to be decreased during fermentation of must. The treatment T₅ i.e. 60 % cashew apple: 40 % aonla juice (6.13 °Brix) recorded lowest T.S.S. and T₉ i.e. 20 % cashew apple: 80 % aonla juice (10.53 °Brix) recorded highest T.S.S. at 12th day of fermentation. The lowest pH recorded in treatment T₉ i.e. 20 % cashew apple: 80 % aonla juice (2.10) and highest recorded in T₁ i.e. 100 % cashew apple juice (3.38) at 12th day of fermentation. On the other hand, titratable acidity of must was found to be increased during fermentation of must. The minimum titratable acidity was found in treatment T₁ i.e. 100 % cashew apple juice (0.62 %) and maximum was recorded in T₉ i.e. 20 % cashew apple: 80 % aonla juice (1.74 %) at 12th day of fermentation. The yeast count increases rapidly until the 3rd day (1524 x 10³) and after that yeast count subsequently declined until the fermentation reaches the 12th day (36.07 x 10³), irrespective of treatments. At the end of fermentation (12th day) highest yeast count was recorded by treatment T₅ i.e. 60 % cashew apple: 40 % aonla juice (60 x 10³) and lowest yeast count was recorded by treatment T₉ i.e. 20 % cashew apple: 80 % aonla juice (21 x 10³). Wine recovery from must ranged between 73.86 and 83.20 per cent. As a result, treatment T₅ (60 % cashew apple juice: 40 % aonla juice) showed better fermentation among all other treatments.

Keywords: Cashew apple juice, aonla juice, must, fermentation

Introduction:

Fermentation is a technique in development of new products with improved physicochemical and sensory qualities. It is comparatively efficient, low energy preservation technique which increases shelf life and decreases the need for refrigeration or other forms of food preservation methods (Pazhaniet *al.*, 2017). Wine is a beverage resulting from fermentation of fruit juice by yeast with proper processing and additive. The cashew apple tree generally originated from Eastern Brazil and introduced by the Portuguese during the 16th century in India. Cashew (*Anacardium occidentale* L.) belongs to the family Anacardiaceae. The tree bears two forms of fruits, the 1st one is most important cashew nut (True fruit) and second one is cashew apple (Pseudo fruit). Cashew nuts are commercially put to use in India but cashew apples are rotten and wasted due to lack of proper preservation technique. "Feni" the alcoholic drink made in Indian state of Goa using discarded cashew apples. (Rameshbabu *et al.* 2023). One of the important fruit crop in India is aonla having botanical name *Emblica officinalis* Gaertn. The fruit aonla commonly known as Indian Gooseberry. Aonla finds a special place in India due to its tremendous medicinal value. Aonla belongs to the family Euphorbiaceae. It is one of the richest source of vitamin C and tannin which is being used for

preparation of various ayurvedic, unani system of medicine, pharmaceuticals, cosmetic and processing industry (Singh and Gaur, 2002). The aonla fruits, because of its high acidity and astringent taste, not palatable for direct consumption therefore it is mainly consumed only after processing. Wine from cashew apple juice can be good for health as it has good antioxidant activity and various studies reported that wine is healthy due to the presence of antioxidants in them. It is highly nutritive and one of the richest source of antioxidants, hence suitable for wine preparations. Due to its high acidity and astringent taste, aonla is primarily consumed after processing. Fermented fruit wines are famous throughout the world. In some regions it makes a significant contribution to the diet of millions of individuals. Different fruits might be used to produce highly palatable wines. As wine consist of both alcohol and antioxidants, hence it is unique among drinks. Drinking wine may have certain health benefits, including boosting heart, gut and brain health. Presence of high acidity in aonla and low in cashew apples they are used for blending in value addition. If blended wine is prepared from both these fruits, the prepared wine will be nutritionally rich and helpful for good health of peoples.

Material and methods:

The experiment "Studies on cashew apple (*Anacardium occidentale* L.) and aonla (*Embllica officinalis* Gaertn.) blended wine" was laid out in Completely Randomized Design with nine treatments viz. T₁ - (100% cashew apple juice), T₂ - (90% cashew apple juice + 10% aonla juice), T₃ - (80% cashew apple juice + 20% aonla juice), T₄ - (70% cashew apple juice + 30% aonla juice), T₅ - (60% cashew apple juice + 40% aonla juice), T₆ - 50% cashew apple juice + 50% aonla juice), T₇ - (40% cashew apple juice + 60% aonla juice), T₈ - (30% cashew apple juice + 70% aonla juice), T₉ - (20% cashew apple juice + 80% aonla juice) and three replication. For this investigation fruits of cashew apple and aonla were collected from the Central Experiment Station, Wakavali of Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth. Cashew apple juice extracted from helicoidal juice extractor machine. For extraction of juice from aonla fruit, the fruits were shredded with aonla shredder and then juice were extracted from shredded aonla with the help of basket press. Then prepared juice of both the fruits was blended as per treatment details and 1 kg of blended juice was taken. The T.S.S. of blended juice was adjusted to 24°B with the help of sugar. After adjustment of T.S.S., the pH of the juice was kept natural. The prepared must was inoculated with yeast culture (*Saccharomyces cerevisiae*) @ 0.3g/kg of must. For the activation of yeast these test tubes were kept at room temperature for 1 hour and then used for inoculation in must. After being inoculated with active yeast culture, the prepared must was kept for fermentation at room temperature. During fermentation, changes in T.S.S., titratable acidity and pH were recorded at alternate day. Yeast count recorded after 3 days interval during fermentation. At last percent wine recovery were recorded. Total soluble solids (T.S.S.) were determined by using Hand refractometer (Erma Japan, 0 to 320B). Titratable acidity (%) and yeast count during fermentation were determined by using methods described by Ranganna (1997). Per cent wine recovery (%) were recorded on the basis of must weight.

Results and Discussion:

The data regarding chemical composition of cashew apple and aonla natural juice is presented in the Table 1. The cashew apple and aonla juice used for preparation of must contained T.S.S., reducing sugars, total sugar, pH, titratable acidity, ascorbic acid and tannins as 13.4 °Brix and 10.8°Brix, 7.44 and 5.22 percent, 10.36 and 7.08 percent, 3.80 and 2.70, 0.37 and 2.37 percent, 210 and 440 mg/100 ml and 1.70 and 2.29 percent, respectively. Similar findings in chemical composition of cashew apple have been recorded by

Damasceno *et al.* (2008) and Anand *et al.* (2015). In case of aonla, similar results have been shown by Kulkarni *et al.* (2017) and Singh *et al.* (2016).

The T.S.S. of must of all the treatments were adjusted to 24 °Brix. The titratable acidity of must was found to have increased from T₁ (0.33 %) to T₉ (1.09 %) may be due to an increase in aonla juice percentage from T₁ (0 %) to T₉ (80%). Similar results have been recorded by Sadgir (2015) while working on cashew apple and pineapple blended wine. The pH of must decreased from T₁ (3.93) to T₉ (2.61) due to increase in acidity from T₁ (0.33 %) to T₉ (1.09 %). As acids are inversely proportional to pH. Nevase (2021) found comparable outcomes when studying the process of producing wine using diluted banana and kokum juice.

The table 3 shows that the must's T.S.S. concentration gradually decreased until fermentation was finished. From the mean values of T.S.S. it is seen that T.S.S. decreased from 23.94 °Brix ('0' day) to 7.60 °Brix (12th day), irrespective of treatments. The maximum reduction in T.S.S. of must was recorded by T₅ (6.1 °Brix) due to better fermentation. Due to conversion of sugar into alcohol the decrease in T.S.S. during the stages of fermentation is observed. The yeast converts sugars into alcohol. Similar results were obtained by Manor (1999) while working on cashew apple wine and Suresh *et al.* (2014) while working on aonla wine. The titratable acidity of the must increases continuously as the fermentation process carry on until it was finished. From mean values it is seen that titratable acidity increased from 0.69 per cent ('0' day) to 1.15 per cent (12th day), irrespective of treatments. The wine yeast can produce various acids during fermentation, this acid found to be responsible for noticeable titratable acidity increases during fermentation. The titratable acidity data indicates the increase in must acidity from T₁ (0.61 %) to T₉ (1.73 %) at the end of fermentation due to decrease in pH from T₁ (3.35) to T₉ (2.13). Acids are inversely proportional to pH. Similar results reported by Bhos (2010) while working on cashew apple wine and Suresh *et al.* (2014) while working on aonla fermented bevarages. The pH of must prepared by blending cashew apple and aonla natural juice were not adjusted. The table 4 shows that the pH of the must decreased continuously as the fermentation process went on until it was finished. From mean value it is seen that must pH decreased from 3.11 ('0' day) to 2.14 (12th day), irrespective of treatments. The reason behind decrease in pH of must may be the production of organic acids during fermentation. Because there is an inverse relation between acids and pH. Manor (1999) also reported similar results while studying on cashew apple wine.

It is seen from table 6, that yeast count increases rapidly until the 3rd day (1528 x 10³) and after that yeast count subsequently declined until the fermentation reaches the 12th day (36.03 x 10³). At 3rd day of fermentation highest yeast count was indicated by treatment T₅ (2146 x 10³) and treatment T₉ (1069 x 10³) recorded lowest yeast count. At the end of fermentation (12th day), highest yeast count was recorded by treatment T₅ (63 x 10³). Whereas lowest yeast count was recorded by treatment T₉ (24 x 10³). Similar results have been recorded by Manor (1999) while working on cashew apple wine. The per cent wine recovery shows increasing trend from T₁ (73.81 %) to T₉ (83.24 %) due to increase in aonla juice percentage from (0) to (80 %). Pawar (2009) also recorded similar results while working on sapota wine.

Table 1: Chemical composition of cashew apple and aonla natural juice

Sr.	Parameters	Cashew apple juice	Aonla juice
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No.			
1	T.S.S. (° Brix)	13.4	10.8
2	Reducing sugars (%)	7.44	5.22
3	Total sugars (%)	10.36	7.08
4	Titratable acidity (%)	0.37	2.37
5	pH	3.80	2.70
6	Ascorbic acid (mg/ 100 ml)	210	440
7	Tannin (%)	1.70	2.29

Table 2: Chemical composition of must prepared by blending cashew apple and aonla natural juice

	Treatments		T.S.S (° Brix)	Titratable acidity (%)	pH
	Cashew apple juice (%)	Aonla juice (%)			
T₁	100	0	24.00	0.33	3.93
T₂	90	10	24.13	0.39	3.57
T₃	80	20	23.93	0.48	3.43
T₄	70	30	24.00	0.54	3.20
T₅	60	40	24.00	0.74	3.04
T₆	50	50	23.86	0.77	2.93
T₇	40	60	23.93	0.81	2.84
T₈	30	70	23.93	1.01	2.77
T₉	20	80	23.93	1.09	2.61
Mean			23.97	0.68	3.14
S. Em (±)			0.06	0.01	0.01
C.D. at 1 %			NS	0.05	0.04

Table 3: Changes in T.S.S. (°Brix) during fermentation of the must

Treatments	0 day	2 nd day	4 th day	6 th day	8 th day	10 th day	12 th day
T₁	24.00	14.60	10.66	9.20	8.06	8.00	8.00
T₂	24.13	13.33	8.60	7.93	7.74	7.00	7.00
T₃	23.86	13.66	10.06	9.00	7.93	7.80	7.80
T₄	24.00	12.78	8.20	7.31	6.68	6.53	6.53
T₅	24.00	12.60	7.91	7.06	6.20	6.13	6.13
T₆	23.86	13.00	8.60	7.73	6.93	6.93	6.93
T₇	23.93	13.86	9.53	8.06	7.20	7.20	7.20
T₈	23.93	14.80	12.00	10.40	9.20	9.20	9.20
T₉	23.93	15.93	12.93	11.06	10.55	10.53	10.53
Mean	23.94	13.82	9.82	8.62	7.85	7.73	7.60

Table 4: Changes in titratable acidity during fermentation of the must

Treatments	0 day	2 nd day	4 th day	6 th day	8 th day	10 th day	12 th day
T₁	0.30	0.35	0.50	0.56	0.57	0.57	0.61
T₂	0.36	0.41	0.66	0.75	0.78	0.78	0.82
T₃	0.45	0.54	0.77	0.83	0.85	0.86	0.90
T₄	0.48	0.63	0.93	0.98	1.00	1.02	1.06
T₅	0.70	0.76	1.06	1.10	1.12	1.12	1.16
T₆	0.74	0.86	1.12	1.16	1.21	1.23	1.27
T₇	0.77	0.92	1.32	1.37	1.38	1.41	1.45
T₈	0.98	1.02	1.46	1.52	1.53	1.56	1.58
T₉	1.03	1.14	1.58	1.64	1.65	1.70	1.73
Mean	0.69	0.76	1.04	1.09	1.11	1.13	1.15

Table 5: Changes in pH during fermentation of the must

Treatments	0 day	2 nd day	4 th day	6 th day	8 th day	10 th day	12 th day
T₁	3.97	3.94	3.79	3.63	3.42	3.39	3.35
T₂	3.54	3.41	3.30	3.23	3.19	3.13	3.10
T₃	3.39	3.26	3.14	3.06	3.00	2.94	2.91
T₄	3.17	3.00	2.91	2.89	2.87	2.81	2.77
T₅	3.01	2.86	2.77	2.75	2.72	2.68	2.63
T₆	2.90	2.81	2.72	2.68	2.61	2.56	2.51
T₇	2.80	2.68	2.56	2.54	2.49	2.45	2.41
T₈	2.73	2.60	2.51	2.46	2.40	2.35	2.32
T₉	2.64	2.51	2.46	2.39	2.30	2.19	2.13
Mean	3.11	3.02	2.91	2.85	2.78	2.73	2.14

Table 6: Changes in yeast count during the fermentation of the must

Treatments	Colony count in numbers x 10 ³				
	0 day	3 rd day	6 th day	9 th day	12 th day
T₁	0	1287	671	230	26
T₂	0	1476	878	278	29
T₃	0	1337	732	244	30
T₄	0	2004	1289	254	55
T₅	0	2146	1475	564	63
T₆	0	1675	1015	331	46
T₇	0	1552	853	264	31
T₈	0	1186	587	180	25
T₉	0	1069	491	155	24
Mean	0	1528	890	301.4	36.03

Table 7: Per cent wine recovery from blended juice of cashew apple and aonla

Wine recovery (%)									
Treatments	T ₁ (100:0)	T ₂ (90:10)	T ₃ (80:20)	T ₄ (70:30)	T ₅ (60:40)	T ₆ (50:50)	T ₇ (40:60)	T ₈ (30:70)	T ₉ (20:80)
Mean	73.81	74.51	75.67	77.32	79.32	80.20	80.65	81.32	83.24
S. Em. (±)	0.94								
C.D. at 1%	3.91								

Conclusion:

The findings suggest that a balanced blend of cashew apple and aonla juices can enhance the fermentation quality and nutritional profile of the wine, offering a novel approach to fruit wine production.

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