



Standardization of novel technique for preparation of ginger (*Zingiber officinale*)-blended wine from different cultivars of pear (*Pyrus communis*)

B L ATTRI¹, ANIL KUMAR², MUKESH SINGH MER³ and ARUN KISHOR⁴

ICAR-Central Institute of Temperate Horticulture, Regional Station, Mukteshwar, Uttarakhand 263 138

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ABSTRACT

In North-West Himalayas including Kumaon region of Uttarakhand pear (*Pyrus communis* L.) cultivars like Jagner, Sand Pear and Kakria are being grown with very high yield and productivity but due to poor market the growers are reluctant to harvest the crop because of which the nutritious fruits are spoiled in the orchards. Except for Jagner which is soft and used for table purpose, there are very few takers for other cultivars like Sand Pear and Kakria. All the cultivars are rich in various phyto-chemical characters including anti-oxidants. Hence, for reducing the huge spoilage of nutritious fruits, an attempt was made to standardize a novel technique for pear wine from three cultivars after blending their juice with 2.5% ginger (*Zingiber officinale* Roc) juice, 0.1% DAHP and 0.2% pectinol. After complete fermentation with yeast, *Saccharomyces cerevisiae* var. *ellipsoideus*, the prepared base wines were siphoned/filtered at regular intervals and stored at ambient conditions. A significant difference was recorded in bio-chemical and sensory quality attributes of the wines after preparation and 6 months storage. Among all the treatments ginger-blended Sand Pear wine prepared by raising the TSS to 22°B and having 2.5% ginger juice had an edge over other treatments in overall quality. A significant reduction in all the parameters was recorded irrespective of the cultivars used for wine preparation. On the basis of the study the cost of production of ginger-blended pear wine was found quite reasonable (₹ 93.10, 73.10 and 73.10/650 ml bottle for Jagner-ginger, Sand Pear-ginger and Kakria-ginger wines respectively) with good profit margin comparable with low alcoholic beverages available in the market.

Key words: Pear cultivars, Pear-ginger wine, Physico-chemical characters, Sensory evaluation

Among temperate fruits pear (*Pyrus commnuis* L.), which is one of the most important fruits after apple, is performing well at different altitudes in the North-West Himalayas on an area of 37 656 ha with an annual production of 185 700 metric tonnes (Anonymous 2014). The harvesting season of the fruit coincides with the monsoon because of which the producers/orchardists do not fetch remunerative price for the harvested produce as the colour of the fruits is not appealing and attractive. Moreover, the transportation is hampered due to landslides and road blockage because of heavy rains rendering fruits to spoil in the orchards in the remote areas of Himalayas. Apart from few cultivars like Jagner, which are used for table purpose on a small scale, others like Sand Pear is left to spoil on the trees as well as in the fields because of its gritty texture unsuitable for preparation of value added products like jam. The production of perry can be a promising alternative for the utilization of sand pear fruit having a very limited outlet

for its direct consumption (Azad *et al.* 1986). The extracted juice of most of the pear cultivars is nutritious having carbohydrates, vitamins, minerals and antioxidants, which can be exploited fully if the juice is converted into value added products. Further, as the extracted pear juice is bland in flavour and taste, it can be enriched by the addition of ginger juice which is available in plenty in this region. It will not only help to convert the nutritious and neglected pear fruits into good quality pear wine having flavour and medicinal value of ginger but also help the farmers to get good price for their crop. Sand pear vermouth is another fortified alcoholic beverage which has been developed from Sand Pear (Attri *et al.* 1994, Joshi *et al.* 1999). Keeping in view the huge availability of pear fruits in the region having very limited/meagre utilization, the present investigations were carried out for the preparation of novel technique of ginger-blended pear and wine from three cultivars being grown in Kumaon region of Uttarakhand.

MATERIALS AND METHODS

The present study was undertaken at ICAR-Central Institute of Temperate Horticulture-Regional Station, Mukteshwar, which is situated at 2200 m above msl in Nainital district of Uttarakhand. The ripened fruits of three cultivars of pear, viz. Jagner, Sand Pear and Kakria

¹Present address: Principal Scientist (email: attri1_cith@rediffmail.com), ICAR-Directorate of Mushroom Research, Solan, Himachal Pradesh. ²Scientist (Plant Pathology) (email: anilrao_mpp@yahoo.co.in), ³Senior Research Fellow (SRF) (email: mermukeshsingh86@gmail.com), ⁴Scientist (Hort.) (email: aruniar@gmail.com)

Table 1 Treatment combination for preparation of ginger-blended pear wine

	Treatment
T ₁	<i>Jagner</i> juice having 20°B+2.5% ginger juice
T ₂	<i>Jagner</i> juice having 22°B+2.5% ginger juice
T ₃	<i>Jagner</i> juice having 24°B+2.5% ginger juice
T ₄	Sand pear juice having 20°B+2.5% ginger juice
T ₅	Sand pear juice having 22°B+2.5% ginger juice
T ₆	Sand pear juice having 24°B+2.5% ginger juice
T ₇	<i>Kakria</i> juice having 20°B+2.5% ginger juice
T ₈	<i>Kakria</i> juice having 22°B+2.5% ginger juice
T ₉	<i>Kakria</i> juice having 24°B+2.5% ginger juice

were procured from the orchards of the farmers around Mukteshwar in Nainital district of Uttarakhand, while the fresh ginger was procured from the local market. The treatment combination for preparation of pear and ginger wine is given in Table 1. After sorting and washing of the fruits, initial parameters like fruit pressure (lb/in²), length (mm), breadth (mm) and weight (g) were recorded by standard methods as described by Ranganna (2009). The extracted juice was also evaluated for total soluble solids (TSS, °B), titratable acidity (%), ascorbic acid (mg/100g), reducing sugars (%), total sugars (%) and total antioxidants (mMTE/L) as per the standard methods (AOAC 2005, Ranganna 2009, Apak *et al.* 2004). The extracted juice of all the cultivars was boiled and an active culture of yeast *Saccharomyces cerevisiae* var. *ellipsoideus* was prepared, which was procured from Department of Food Science and Technology, UHF, Solan and maintained in the laboratory. The boiled and cooled juice was added with di-ammonium hydrogen phosphate (DAHP) @ 0.1%, pectinol @ 0.2% and ginger juice @ 2.5%. The quantity of ginger juice was standardized through initial trials, where 2.5% was found to be the best. The TSS of the juice having 2.5% ginger juice was ameliorated to 20, 22 and 24°B by sugar syrup in all the cultivars. An active culture of yeast *Saccharomyces cerevisiae* var. *ellipsoideus* (5%) was added in the musts and the fermentation was carried out at room temperature (24±1°C) in 5 litre capacity volumetric flasks. The fermentation rate was recorded and when the TSS became stable the base wine was siphoned, filtered and filled in the bottles for further evaluation.

The TSS (°B), alcohol (%v/v), titratable acidity (%), volatile acidity (%AA), sugars (%), ascorbic acid (mg/100g), total phenols (mg/l), aldehydes (mg/l), esters (mg/l) and total antioxidants (mMTE/L) were estimated as per the standard methods (AOAC 2005, Ranganna 2009, Caputi *et al.* 1968, Pilone *et al.* 1972, Amerine and Ough 1979, Libraty 1961, Singleton and Rossi 1965, Apak *et al.* 2004) at

0 and 6 months storage. The pear ginger wine from all the cultivars was also evaluated for sensory quality characters immediately after the preparation and 6 months storage by a panel of judges in which they were asked to give score out of 20 for various parameters like colour, body and appearance, aroma, taste, astringency and overall quality. The data on physico-chemical characters of various treatments of pear and ginger wine from different cultivars were recorded in triplicate and statistically analysed by completely randomized block design (CRBD) as per method given by Cochran and Cox (1953), whereas the data for sensory evaluation were analysed as per the method of Mahony (1985). The flow diagram (Fig 1) and cost of production of the pear and ginger wine has also been given.

RESULTS AND DISCUSSION

The data on various physico-chemical characters of different cultivars of pear used in the present study have been given in Fig 2, which revealed a significant difference indicating a genetic variability among the cultivars. The results are in conformity with those reported by Kumar and Chandel (2010) for various cultivars of pear. The fermentation rate (fall of TSS/24 hour) of all the treatments has been depicted in Fig 3. It was found that the fermentation rate was comparatively higher in the treatments having lower TSS and it decreased with the increase in the TSS. It could be due to higher production of alcohol which might have restricted the fermentation rate. Joshi *et al.* (1990) has also reported acceleration of fermentation rates of fruit juices

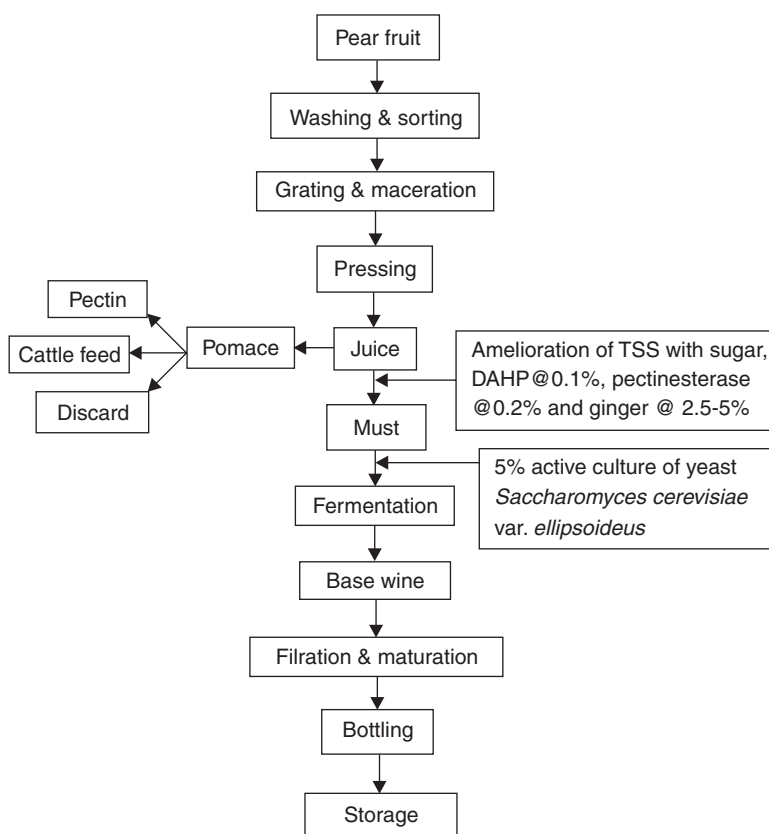


Fig 1 Flow diagram for the preparation of pear-ginger wine

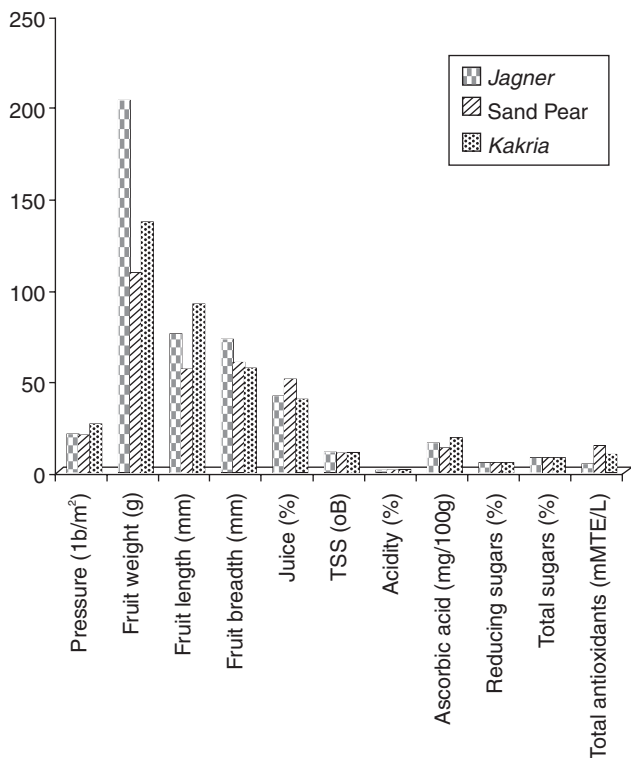


Fig 2 Physico-chemical characters of various cultivars of pear

when these were blended with honey. The fermentation rate of the cashew apple juice treated with 0.5% gelatin and having ameliorated TSS, 0.1% DAHP and 100 ppm KMS was better and fermentation completed in 15 days (Attri et al. 1998).

The physico-chemical parameters of ginger-blended pear wine from three cultivars having different TSS at 0 and 6 months have been shown in Table 2 and 3 depicting a significant difference amongst various treatments. As per the

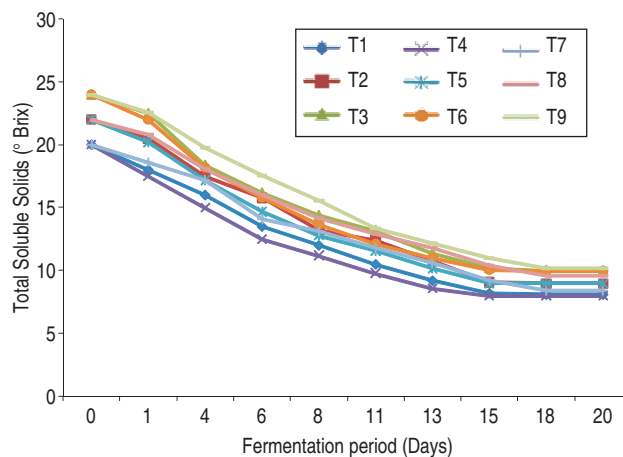


Fig 3 Fermentation rate of different treatments of pear of various cultivars

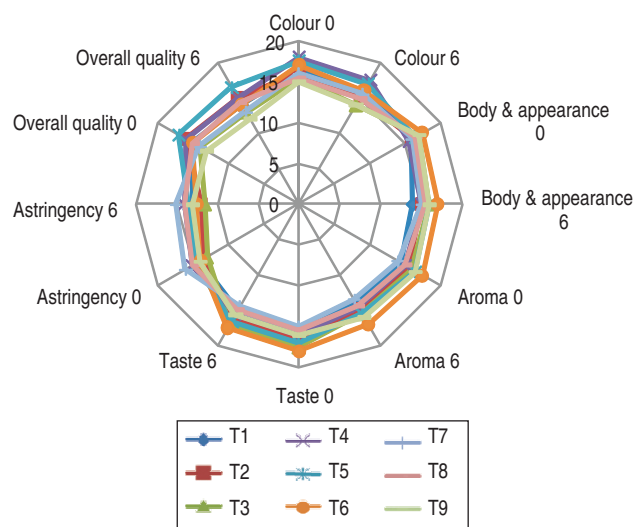


Fig 4 Sensory evaluation of wine of various treatments of pear cultivars at 0 and 6 months

Table 2 Physico-chemical characters of base wine of various treatments of pear cultivars

Treatment	Physico-chemical characters									
	TSS (°B)	Alcohol (%v/v)	Titrateable acidity (%)	Volatile acidity (%AA)	pH	Ascorbic acid (mg/100g)	Total phenols (mg/l)	Aldehydes (mg/l)	Esters (mg/l)	Total antioxidants (mMTE/l)
T ₁	8.1	10.4	0.540	0.020	3.02	6.00	200.0	100.0	166.4	3.854
T ₂	9.0	11.2	0.608	0.025	3.00	6.60	208.0	105.0	172.0	4.110
T ₃	10.0	12.3	0.678	0.030	2.98	7.20	216.0	110.0	180.0	4.220
T ₄	8.0	10.2	0.707	0.025	2.96	8.30	210.0	108.0	185.2	14.120
T ₅	9.0	11.1	0.742	0.030	2.92	8.90	218.0	114.0	192.4	14.250
T ₆	10.0	12.3	0.808	0.035	2.88	9.80	224.0	117.0	200.0	14.410
T ₇	8.4	10.2	0.776	0.030	2.90	10.20	220.0	113.0	194.6	9.140
T ₈	9.6	11.3	0.840	0.036	2.86	11.00	228.0	119.0	202.0	9.375
T ₉	10.2	12.2	0.894	0.040	2.82	11.60	234.0	124.0	206.2	9.620
Mean	9.14	11.24	0.732	0.030	2.92	8.84	217.55	112.22	188.7	9.233
CD (P=0.05)	0.13	0.91	0.572	0.034	0.34	0.13	4.50	3.64	3.43	0.179
Sem	0.43	0.30	0.190	0.11	0.11	0.46	1.50	1.21	1.14	0.59
CV	0.82	0.47	0.451	0.66	0.67	0.91	1.19	1.87	1.04	1.12

Table 3 Physico-chemical characters of wine of various treatments of pear cultivars after 6 months

Treatment	Physico-chemical characters									
	TSS (°B)	Alcohol (%v/v)	Titratable acidity (%)	Volatile acidity (%AA)	pH	Ascorbic acid (mg/100g)	Total phenols (mg/l)	Aldehydes (mg/l)	Esters (mg/l)	Total antioxidants (mMTE/l)
T ₁	8.0	10.2	0.536	0.025	3.04	5.88	205.0	98.0	170.5	3.804
T ₂	8.6	11.1	0.603	0.030	3.02	6.47	212.0	102.0	178.0	3.975
T ₃	9.2	12.1	0.670	0.035	3.00	7.05	220.0	108.0	184.0	4.172
T ₄	8.1	10.1	0.703	0.030	2.98	8.23	216.0	106.0	189.5	13.742
T ₅	8.8	11.0	0.737	0.035	2.94	8.82	222.0	110.0	196.0	13.950
T ₆	9.4	12.1	0.804	0.040	2.90	9.40	230.0	113.0	202.5	14.110
T ₇	8.1	10.0	0.770	0.032	2.92	9.99	224.0	110.0	198.0	9.018
T ₈	8.7	11.0	0.837	0.038	2.88	10.58	232.0	115.0	204.0	9.251
T ₉	9.5	12.0	0.887	0.044	2.85	11.17	238.0	119.0	210.5	9.472
Mean	8.71	11.06	0.727	0.034	2.94	8.62	222.11	109.0	192.5	9.054
CD (P=0.05)	0.15	0.15	0.38	0.030	0.34	0.58	3.91	3.78	2.96	0.96
Sem	0.50	0.52	0.12	0.10	0.11	0.19	1.30	1.26	0.99	0.32
CV	1.01	0.82	0.30	0.51	0.67	0.39	1.01	2.00	0.89	0.61

initial TSS, the variation in the final TSS of the wines was recorded which indicated that after a certain level of alcohol production the activity of the yeast ceases. Corresponding to the TSS, the alcohol (%) also varied in different treatments and it was noticed that about 50% of the TSS was utilized for alcohol production. During storage there was a reduction in the TSS and alcohol which may be attributed due to sedimentation and volatility. The titratable acidity (%) and volatile acidity (% Acetic acid) was found to increase in all the treatments with increase in TSS as well as storage period which may be due to more alcohol production. The pH of the products was found in corroboration with the titratable acidity. The reducing and total sugars (%) were non-detectable in all the treatments immediately after preparation and 6 months storage indicating that the same have been utilized for alcohol production. Further, ascorbic acid (mg/100g) in various treatments of pear ginger wine was retained better having higher alcohol (%) in the final product. The total phenols (mg/l), aldehydes (mg/l), esters (mg/l) and total antioxidants (mMTE/L) were found to increase with increase in the TSS and alcohol production and also retained better after 6 months of storage which indicated that the alcohol plays a significant role in the production and retention of these constituents in the wines. In four days fermentation in two varieties of pineapple juice having 20°B TSS and 100 ppm KMS, acidity and ascorbic acid content decreased significantly and physico-chemical characteristics of the pineapple wine were found comparable to similar other fruit wines (Attri and Singh 2002). With increased level of alcohol, TSS, pH, aldehydes, esters and phenols were found to increase while titratable acidity and vitamin C decreased (Joshi *et al.* 1991). Pear fruits contain good quantity of antioxidants, which is maintained when the juice is converted to alcohol, the health benefits of which

are well documented in various berry or fruit wines (Cakar *et al.* 2016, Du *et al.* 2012).

The prepared pear ginger wines of different treatments

Table 4 Cost of production of pear ginger wine from different cultivars of pear

Material required	Prepared wine		
	Jagner + ginger	Sand pear + ginger	Kakria + ginger
Cost of 50 kg fruit (₹)	1000.00 (20×50)	500.00 (10×50)	500.00 (10×50)
Cost of 2 kg ginger (₹)	160.00 (80×2)	160.00 (80×2)	160.00 (80×2)
Cost for extraction of juice (₹)	250.00	250.00	250.00
Cost of 6 kg sugar (₹)	240.00 (40×6)	240.00 (40×6)	240.00 (40×6)
Cost of DAHP, Pectinestrase and KMS	60.00	60.00	60.00
Cost of 50 bottles (650 ml) and crown corks (₹)	500.00 (10×50)	500.00 (10×50)	500.00 (10×50)
Miscellaneous expenditure (₹)	100.00	100.00	100.00
Total (₹)	2310.00	1810.00	1810.00
Overhead charges @20% (₹)	462.00	362.00	362.00
Additional charges @ 10% in fermentation (₹)	277.00	217.00	217.00
Grand total (₹)	3049.00	2389.00	2389.00
Sales tax @ 27.5 (₹)	847.00	657.00	657.00
Profit @ 20% (₹)	759.00	609.00	609.00
Total (₹)	4655.00	3655.00	3655.00
Sale price per bottle (₹)	93.10	73.10	73.10

were evaluated for sensory quality attributes at different intervals of storage and it was found that the pear-ginger wine from sand pear having TSS of 22°B with 2.5% ginger had an edge over other combinations (Fig 4) immediately after preparation and after 6 months storage. The products were found safe at ambient conditions after 6 months storage. Earlier, Attri *et al.* (2014) and Krishna *et al.* (2014) also noted that blending of fruit juice with ginger juice improves the sensory attributes of the beverages. Joshi *et al.* (1990) revealed that out of various fruit honey wines, apple honey wine was found to be the best for various quality parameters.

From the cost of production of the prepared products it was found that it quite reasonable (₹ 93.10, 73.10 and 73.10/650 ml bottle for Jagner ginger, Sand Pear ginger and Kakria ginger wines respectively) with good profit margin comparable with low alcoholic beverages available in the market (Table 4). The cost may further be reduced if the production is on commercial scale by any processing unit in the production areas.

It can be concluded from the present study that the neglected but nutritious pear fruits of different cultivars found growing in the Himalayan region of the country can successfully be utilized for the novel value added products by enhancing the overall quality with ginger juice. It will restrict the huge spoilage of the fruits and encourage the producers to cultivate these fruit crops in this region.

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