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Standardization of recipe for gulkand and evaluation of its physico-chemical characteristics during storage

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Abstract
The experiment entitled "Standardization of recipe for gulkand and evaluation of its physico-chemical characteristics during storage" was carried out in the Pt. K.L. Shukla College of Horticulture and Research Station Rajnandgaon (C.G) during 2019-2020.
This experiment was carried out in completely randomized design with twelve treatments of gulkand with three times replication. The effect of ingredient combination on sensory evaluation, physico-chemical characteristics at the time of storage was evaluated.
The objective was to study best recipe used for preparation, analyze the physico-chemical, sensory evaluation during storage at ambient conditions and to work out the economical feasibility of gulkand under various treatment Among all gulkand combination, treatment T_4-rose petal + sugar (1:1.25w/w) was found the most suitable than all different treatments with respect to total sugar (63.34%), non-reducing sugar (55.89%), total soluble solids (73.68 ^{0}Brix), sensory qualities i.e. color (8.56), texture (9.38) and overall acceptability (8.77) along with least increase in acidity (0.10%). Maximum ascorbic acid retention (20.11mg $100g^{-1}$) was recorded in treatment T_1-rose petal + sugar (1:0.5w/w) while highest flavor (8.78) in T_2- rose petal + sugar (1:0.75 w/w) whereas taste (8.93) and pH (5.23) in T_3- rose petal + sugar (1:1 w/w). Treatment T_4 also recorded highest gross return of Rs. 600/Kg, net return of Rs.386/ Kg along with B: C (1:1.80) as compared to other treatments under study under observation.

Keywords: Gulkand, sensory quality, treatment

Introduction
Flowers are among the loveliest objects on this earth of ours and among them rose is the queen (Pal, 2005) [9]. Floriculture is a highly growing and highly economical industry. It has presented as a lucrative profession with much big potential for returns compared to other agri-horticultural crops. The science and art of trading floriculture has been acknowledged as an economic activity with the power for creating employment and receiving valuable foreign exchange. (Sudhagar, 2013) [12].
The Rose plant belong to the family of rosaceae and genus *Rosa*, It contains diploid C.N. (2n) =14 which include 200 sp. and more than 18000 cultivars. (Ginova *et al.*, 2013) [7]. In India total area under rose is about 30.87 million hectares with a production of 212.67 thousand MT during 2015-16. (Anonymous, 2015) [2]. In Chhattisgarh rose flower is grown in 1249 Ha with the production of 2904 MT. Karnataka, Gujrat, Andhra Pradesh, odisha, Uttar Pradesh, Madhya Pradesh, Maharashtra, Assam, Chhattisgarh and Haryana are the most vital rose growing states in our country. (Anonymous, 2017) [3]. Apart from petals, rose leaves are also rich source of anthocyanin and phenolic compounds. (Huang *et al.*, 2009) [8].
It can be equally used as energizers well as a laxative (Rode and ogale, 1984). In Industries like food, medicinal, and beauty products Rose finds its claim. Rose has a high content of mineral, essential oil, vitamin C, carotenoid and phenolic components carrying high nutrition in its food. Rose petals have also been used in teas, cakes and flavour extracts for many years (Mabellini *et al*., 2011). Rose hips also contain a good amount of vitamin C. (Rode and Ogale, 1984). Value addition is any step taken to increase the value and form of a raw product at any time from harvesting to sale of the finished product. In national and international markets rose water, rose oil, gulkand, pankhuri and gul-roghan are commercial rose products.
Gulkand is a sweet preserve made by mixing together a blend of rose petals and sugar in equal ratio. It is one of the most delicious ayurvedic preparations which has been used from ancient times for good strength. Gulkand is mainly prepared from sp. like *R. chinensis, R. gallica, R. pomifera, R. centifolia* and *R. bourboniana*. Among the diverse varieties, *damask rose* (*Rosa damascena* Mill.) is the main rose species utilized to make rose oil, rose water, gulkand,

concrete and absolute which are valuable and important raw materials for the perfume and cosmetic industry. Consumption of gulkand provides a list of the profits on a ordinary basis according to the National Institute of Ayurvedic Medicine. It also finds its use in cooling tonic, laxative to resist fatigue, lethargy, hyperacidity, fluid retention and heat related conditions. It also finds its application for boosting memory and used as blood purifier (Ayushveda). Flowers of 'rose edouard' from which the sepals have been removed are mostly used. In Maharashtra, Rajasthan, Madhya Pradesh, Karnataka and Andhra Pradesh. Gulkand is greatly in demand. UP is one of the best in 'gulkand' production in the country, with Kannauj being a major hub. (Ayci *et al.*, 2005) [4].

Gulkand can make excellent flower processed products due to its high flavour and nutritional value and can reduce post-harvest losses. Gulkand is one of the most appetizing ayurvedic preparations. Gulkand is used as a sweeting agent in beetle vine which is highly consumed in Chhattisgarh.

Materials and Method

This research was performed in processing laboratory, Pt. K. L. Shukla College of Horticulture and Research Station Rajnandgaon. The district is situated at distance of 85 km away from Indira Gandhi Agriculture University, Raipur. The district is located in North-Eastern part of Chhattisgarh at 20˚07 N and 22º29 N latitude and 80º23 E and 81º 24 longitude with an altitude of 330.71 meter above the mean sea level. It comes under sub-tropical condition and has an annual average rainfall of 953mm. The highest temperature raises 45.9 °C during the summer and lowest temperature as 16 °C during winter season.

Experimental details

Fresh rose petals, sugar, honey, and jaggery are the raw material used for performing the experiment. Rose flowers were collected from local flower market of Rajnandgaon. Ingredients like sugar, honey, and jaggery were collected from the general grocery shop. They were then labeled and stored under ambient condition for 0, 20, 40 and 60 days observations. The sensory parameters viz.; colour, texture, taste, flavour and overall acceptability based on 9 point hedonic scale (Amerine *et al*., 1965) [1]. The data were analysed by using completely randomized design (Fisher, 1950).

Treatment	Composition
T_1	Rose petals + Sugar (1:0.5w/w)
T_2	Rose petals + Sugar (1:0.75w/w)
T_3	Rose petals + Sugar (1:1w/w)
T_4	Rose petals + Sugar (1:1.25w/w)
T_5	Rose petals + Honey (1:0.5w/w)
T_6	Rose petals + Honey (1:0.75w/w)
T_7	Rose petals + Honey (1:1w/w)
T_8	Rose petals + Honey (1:1.25w/w)
T_9	Rose petals + Jaggery (1:0.5w/w)
T_{10}	Rose petals + Jaggery (1: 0.75w/w)
T_{11}	Rose petals + Jaggery (1: 1w/w)
T_{12}	Rose petals + Jaggery (1:1.25)

Observation

Chemical analysis of gulkand during storage period (0, 20, 40 & 60 days)

I. **Total soluble solids (^{0}Brix):** TSS content of gulkand was measured directly by means of the "Digital Refractometer" (Brix: 0.0 to 53.0, 58.0 to 95.0%) at 22 ^{o}C temperature which works on the principle of refraction of light.
II. **Ascorbic acid (mg 100 g^{-1}):** Ascorbic acid of gulkand was evaluated through methodology given by Ranganna (1986).
III. **Titratable Acidity (%):** Total acid percent of gulkand was resoluted through the method suggested by Ranganna (1986). The acidity percent was known by diluting the known volume of gulkand and titrating it against 10 ml against standard solution of N/10 sodium hydroxide using phenolphthalein as indicator
IV. **Active acidity (pH):** pH meter was used to measure the pH of the gulkand after calibrating the instrument with standard buffer solution
V. **Total sugar (%):** Total sugar content of gulkand was evaluated by using "Lane and Eynon method" suggested by Ranganna (1986).
VI. **Reducing sugar (%):** Reducing sugar of gulkand was analyzed by "Lane and Eynon method" as described by Ranganna (1986).
VII. **Non-reducing sugar (%):** Non reducing sugar was determined by subtracting reducing sugar from total sugar.

Chemical analysis of gulkand during storage period (0, 20, 40 & 60 days)

Total soluble solids (^{0}Brix)

It is apparent from the result obtained in the table 1 that TSS content of stored gulkand raised with the high range of sugar, honey and jaggery along with the progression of storage duration in all the treatments. The highest TSS (^{0}Brix) ranged 73.68 ^{0}B in treatment arrangement T_4-rose petals + sugar (1:1.25 w/w) next was T_3-rose petals + sugar (1:1w/w) and the lowest 43.34^{0}B was T_5-rose petals + honey (1:0.05 w/w) at 60 days of storage duration. Similar findings were also reported by Chanbisana and Banik (2007).

Ascorbic acid (mg 100g^{-1})

Data presented in Table 2 shows that the ascorbic acid content of gulkand declined significantly on adding high range of sugar, honey and jaggery with the progression of storage period. At initial storage duration, the highest ascorbic acid content (20.20 mg 100g $^{-1}$) was recorded in treatment T_1-rose petals + sugar (1:0.05 w/w) and next was T_2- rose petals + sugar (1:0.75 w/w), and lowest ascorbic acid content (11.12 mg 100 g^{-1}) was noted under treatment T_{12}-rose petals + jaggery (1:1.25 w/w) at 60 days of storage duration. These findings are similar to Patel *et al*. (2015) [10].

Acidity (%)

Data represented in Table 3 reveals that acidity of gulkand raised slightly with the advancement of storage duration. However at initial stage, addition of increased quantity of sugar, honey, and jaggery lower down the percent acidity. The maximum acidity percent (0.47%) was recorded in treatment T_9- rose petals + jaggery (1:0.5 w/w) and next was T_{10}-rose petals + sugar (1:0.75 w/w) while minimum acidity percent (0.10%) was recorded in treatment T_4-rose petals + sugar (1:1.25 w/w) at 60 days storage duration. Similar findings are also obtained by Chanbisana and Banik (2007).

pH

It is apparent from the data presented in Table 4 that pH of

gulkand significantly raised on adding high quantity of sugar, honey and jaggery while it decreased with the progression of storage period. The highest pH (5.23) was recorded under T_3-rose petals + sugar (1:1.25 w/w), then next was T_4-rose petals + sugar (1:1 w/w) while the lowest pH (4.50) was recorded in treatment T_9-rose petals + jaggery (1:0.5 w/w) at 60 days of storage period.

Total sugars (%)

From the data presented in Table 5 it is clear that total sugar content of gulkand raised with high level of ingredients like sugar, honey and jaggery combination along with progression of storage duration. The highest increase in total sugar content (63.34%) was recorded under treatment T_4-rose petals + sugar (1:1.25 w/w) next was T_3-rose petals + sugar (1:1 w/w) while lowest increase in total sugar content (44.43%) was recorded in T_5-rose petals + honey (1:0.5 w/w) at initial level of 60 days storage duration. Our results are in conformity with the results obtained by Shakir *et al*. (2009) [11].

Reducing sugar (%)

An examination of data representation in Table 6 showed that the reducing sugar content in gulkand raised on adding high range of sugar, honey and jaggery during successive stages of storage duration. The highest increase in reducing sugar content (44.56%) was found in treatment T_8 -rose petals + honey (1:1.25 w/w) next was T_7-rose petals + honey(1:1 w/w) while lowest increase in reducing sugar(2.34%) was recorded in treatment T_1-rose petals + sugar (1:0.5 w/w) at initial to 60 days of storage duration. Present findings are in conformity with the findings of Shakir *et al*. (2009) [11].

Non reducing sugar (%)

Data presented in Table 7 made it clear that different treatments significantly affect the non-reducing sugar content of gulkand at ambient condition. Among the variety of treatments, minimum decrease in non-reducing sugar content (55.89%) was recorded under treatment T_4-rose petal + sugar (1:1.25 w/w) next was T_3-rose petal + sugar (1:1 w/w) whereas maximum decrease in non-reducing sugar content (9.13) was recorded under T_5-rose petals + honey (1:0.75 w/w) at initial to 60 days storage duration. These results were similar to the study by Patel *et al*. (2015) [10].

Table 1: Effect of ingredient combination on TSS (^{0}B) content of gulkand during ambient storage

Treatment	0 days	20 days	40 days	60 days	mean
Rose petals + Sugar (1:0.5w/w)	65.16	66.74	68.07	70.26	67.56
Rose petals+ Sugar (1:.75w/w)	68.12	69.32	71.00	71.00	69.86
Rose petals + Sugar (1:1.w/w)	69.28	70.34	71.55	72.67	70.96
Rose petals + Sugar (1:1.25w/w)	70.41	70.99	72.02	73.68	71.77
Rose petals + Honey (1:0.5w/w)	43.34	44.21	45.33	46.49	44.84
Rose petals + Honey (1:0.75w/w)	45.31	46.67	47.22	49.98	47.29
Rose petals + Honey (1:1w/w)	46.27	48.62	49.86	51.22	48.99
Rose petals + Honey (1:1.25w/w)	47.16	50.12	51.56	52.56	50.35
Rose petals+ Jaggery (1:0.5w/w)	49.92	52.12	52.69	53.76	52.12
Rose petals+ Jaggery (1:0.75w/w)	52.88	53.52	54.67	56.53	54.40
Rose petals+ Jaggery (1: 1w/w)	53.45	54.27	56.25	57.72	55.42
Rose petals + Jaggery(1:1.25)	53.80	55.11	57.32	57.86	56.02
C.D.	1.18	1.21	1.42	1.97	
SE(m)	0.40	0.41	0.48	0.67	
C.V.	1.26	1.26	1.44	1.95	

Table 2: Effect of ingredient combination on ascorbic acid content of gulkand during ambient storage

Treatment	0 days	20 days	40 days	60 days	Mean
Rose petals + Sugar (1:0.5w/w)	20.20	17.15	15.19	13.19	16.43
Rose petals + Sugar (1:1.w/w)	18.40	15.16	12.63	11.50	14.42
Rose petals + Sugar (1:1.25w/w)	17.60	15.20	12.63	11.14	14.14
Rose petals + Honey (1:0.5w/w)	19.50	17.40	15.14	14.17	16.55
Rose petals + Honey (1:0.75w/w)	16.50	14.00	12.93	12.48	13.98
Rose petals + Honey (1:1w/w)	15.50	13.60	12.60	12.26	13.49
Rose petals + Honey (1:1.25w/w)	13.77	13.40	12.48	12.26	12.98
Rose petals + Jaggery (1:0.5w/w)	19.37	17.22	15.17	14.17	16.48
Rose petals +Jaggery (1:0.75w/w)	16.40	15.80	12.81	11.77	14.20
Rose petals + Jaggery (1: 1w/w)	15.50	14.61	12.29	11.21	13.40
Rose petals + Jaggery(1:1.25)	14.60	13.50	12.23	11.12	12.86
C.D.	1.04	0.95	0.64	0.50	
SE(m)	0.35	0.32	0.22	0.17	
C.V.	3.58	3.69	2.84	2.40	

Table 3: Effect of ingredient combination on acidity content of gulkand during ambient storage

Treatment	0 days	20 days	40 days	60 days	Mean
Rose petals + Sugar (1:0.5w/w)	0.14	0.15	0.17	0.21	0.17
Rose petals+ Sugar (1:.75w/w)	0.12	0.13	0.15	0.17	0.14
Rose petals + Sugar (1:1.w/w)	0.11	0.12	0.15	0.16	0.13
Rose petals + Sugar (1:1.25w/w)	0.10	0.12	0.13	0.15	0.12
Rose petals + Honey (1:0.5w/w)	0.23	0.25	0.26	0.28	0.26

Rose petals + Honey (1:0.75w/w)	0.22	0.23	0.25	0.28	0.24
Rose petals + Honey (1:1w/w)	0.21	0.20	0.24	0.25	0.22
Rose petals + Honey (1:1.25w/w)	0.18	0.19	0.20	0.23	0.20
Rose petals+ Jaggery (1:0.5w/w)	0.42	0.44	0.45	0.47	0.45
Rose petals+ Jaggery (1:0.75w/w)	0.41	0.41	0.45	0.46	0.43
Rose petals+ Jaggery (1: 1w/w)	0.40	0.40	0.43	0.45	0.42
Rose petals + Jaggery(1:1.25)	0.36	0.39	0.43	0.44	0.40
C.D.	0.04	0.02	0.01	0.01	0.02
SE(m)	0.01	0.01	0.00	0.01	0.01
C.V.	4.12	3.80	2.72	2.78	

Table 4: Effect of ingredient combination on pH content of gulkand during ambient storage

Treatment	0 days	20 days	40 days	60 days	Mean
Rose petals + Sugar (1:0.5w/w)	5.07	5.03	4.89	4.57	4.89
Rose petals+ Sugar (1:.75w/w)	5.11	5.09	5.02	4.93	5.04
Rose petals + Sugar (1:1.w/w)	5.23	5.14	5.08	5.08	5.11
Rose petals + Sugar (1:1.25w/w)	5.14	5.19	5.16	5.12	5.17
Rose petals + Honey (1:0.5w/w)	4.93	4.87	4.76	4.54	4.78
Rose petals + Honey (1:0.75w/w)	5.03	4.92	4.82	4.53	4.83
Rose petals + Honey (1:1w/w)	5.12	5.06	5.05	4.53	4.94
Rose petals + Honey (1:1.25w/w)	5.18	5.15	5.13	4.52	5.00
Rose petals+ Jaggery (1:0.5w/w)	4.78	4.63	4.54	4.50	4.61
Rose petals+ Jaggery (1:0.75w/w)	4.89	4.74	4.63	4.52	4.69
Rose petals+ Jaggery (1: 1w/w)	5.12	5.09	5.06	4.64	4.98
Rose petals + Jaggery(1:1.25)	5.14	5.24	5.15	4.81	5.08
C.D.	0.14	0.32	0.28	0.29	
SE(m)	0.05	0.11	0.10	0.10	
C.V.	1.60	3.74	3.35	3.59	

Table 5: Effect of ingredient combination on total sugar content of gulkand during ambient storage

Treatment	0 days	20 days	40 days	60 days	Mean
Rose petals + Sugar (1:0.5w/w)	58.04	58.95	59.06	59.11	58.79
Rose petals+ Sugar (1:.75w/w)	60.83	61.32	61.89	62.45	61.62
Rose petals + Sugar (1:1.w/w)	60.9	61.56	62.32	63.00	61.94
Rose petals + Sugar (1:1.25w/w)	61.3	62.32	63.21	63.34	62.54
Rose petals + Honey (1:0.5w/w)	44.43	45.65	46.5	46.96	45.88
Rose petals + Honey(1:0.75w/w)	47.46	48.65	48.8	48.96	48.46
Rose petals + Honey (1:1w/w)	48.65	49.03	49.48	50.54	49.42
Rose petals + Honey(1:1.25w/w)	49.32	49.67	50.3	50.2	49.87
Rose petals+ Jaggery (1:0.5w/w)	48.42	48.98	49.22	51.61	49.56
Rose petals +Jaggery(1:0.75w/w)	50.43	51.54	52.34	53.45	51.94
Rose petals+ Jaggery (1: 1w/w)	51.40	52.44	52.67	53.56	52.51
Rose petals + Jaggery(1:1.25)	51.28	52.53	53.56	53.66	52.76
C.D.	3.75	3.44	2.965	2.22	
SE(m)	1.27	1.17	1.01	0.75	
C.V.	4.19	3.79	3.232	2.39	

Table 6: Effect of ingredient combination on reducing sugar content of gulkand during ambient storage

Treatment	0 days	20 days	40 days	60 days	Mean
Rose petals + Sugar (1:0.5w/w)	2.34	3.89	5.42	7.64	4.82
Rose petals+ Sugar (1:.75w/w)	3.03	4.06	6.54	8.46	5.52
Rose petals + Sugar (1:1.w/w)	3.06	4.33	6.76	8.76	5.73
Rose petals + Sugar (1:1.25w/w)	3.09	4.89	6.56	8.88	5.86
Rose petals + Honey (1:0.5w/w)	33.21	36.24	39.47	40.54	37.36
Rose petals + Honey (1:0.75w/w)	35.54	38.87	42.65	43.42	40.12
Rose petals + Honey (1:1w/w)	35.50	39.54	42.87	44.12	40.51
Rose petals + Honey (1:1.25w/w)	37.32	39.78	43.20	44.56	41.21
Rose petals + Jaggery (1:0.5w/w)	14.09	16.98	18.43	20.43	17.48
Rose petals + Jaggery (1:0.75w/w)	17.56	20.33	21.76	22.42	20.52
Rose petals + Jaggery (1: 1w/w)	18.45	20.67	22.21	23.67	21.25
Rose petals + Jaggery(1:1.25)	18.89	20.87	23.19	23.87	21.70
C.D.	1.13	1.36	1.10	1.20	
SE(m)	0.38	0.46	0.38	0.41	
C.V.	3.59	3.85	2.80	2.85	

Table 7: Effect of ingredient combination on non-reducing sugar content of gulkand during ambient storage

Treatment	0 days	20 days	40 days	60 days	Mean
Rose petals + Sugar (1:0.5w/w)	55.70	55.06	53.64	51.52	53.97
Rose petals+ Sugar (1:.75w/w)	57.80	57.26	55.35	53.99	56.10
Rose petals + Sugar (1:1.w/w)	57.84	57.23	55.56	54.24	56.22
Rose petals + Sugar (1:1.25w/w)	58.19	57.44	56.33	55.89	56.96
Rose petals + Honey (1:0.5w/w)	9.13	9.42	7.27	5.09	7.72
Rose petals + Honey (1:0.75w/w)	10.59	9.78	6.15	5.76	8.07
Rose petals + Honey (1:1w/w)	11.33	9.57	6.96	5.36	8.30
Rose petals + Honey (1:1.25w/w)	11.42	9.89	7.09	6.04	8.61
Rose petals + Jaggery (1:0.5w/w)	32.73	33.00	30.72	31.03	31.86
Rose petals+ Jaggery (1:0.75w/w)	32.87	31.21	30.58	30.69	31.33
Rose petals + Jaggery (1: 1w/w)	32.99	31.79	30.45	29.89	31.27
Rose petals + Jaggery(1:1.25)	33.06	30.99	30.42	29.97	31.11
C.D.	0.71	0.77	1.11	1.13	
SE(m)	0.24	0.26	0.38	0.39	
C.V.	1.24	1.39	2.11	2.23	

Conclusion

The result and discussion of the present study indicate following points.

It may be concluded that among various gulkand combination, treatment T_4-rose petal + sugar (1:1.25w/w) was found the most suitable for all different treatments with respect to total soluble solids (73.6 ^{0}B), total sugar (63.34%), non-reducing sugar (55.89%).

It may be concluded that pH of gulkand significantly raised on adding high quantity of sugar, honey and jaggery while it decreased with the progression of storage period. The highest pH (5.23) was recorded in treatment T_3 -rose petal + sugar (1:1 w/w).

It can be concluded that Sensory qualities showed declining trend with the advancement of storage days i.e. colour (8.56), texture (9.38) and overall acceptability (8.26) was found best in treatment combination T_4-rose petal + sugar (1:1.25w/w) whereas highest flavor was found in T_2 (8.78)-rose petal + sugar (1:0.75 w/w) and taste (8.93) was found in T_3 -rose petal + sugar (1:1 w/w).

Addition of increased quantity of sugar, honey, and jaggery lower down the percent acidity. Minimum acidity percent 0.10% was recorded in treatment T_4-rose petals + sugar (1:1.25 w/w).

It may be concluded that reducing sugar of gulkand raised with high level of ingredients like sugar, honey and jaggery combination along with progression of storage duration in all the treatments and highest reducing sugar(44.56%) was recorded in T_8 -rose petal + sugar (1:0.75 w/w).

It may be concluded that T_4 -rose petal + sugar (1:1.25w/w) treatment recorded to have the highest gross return of 600/Kg and net return of 386/Kg and B:C (1.80).

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