

Nutritional, sensory and physicochemical properties of red sweet cherry powder incorporated cookies

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Abstract

Cherries in particular sweet cherries are a nutritionally dense fruit which contain good taste, attractive appearance, small in size and limestone fruit. Cherries are used in both fresh and processed form in human diet. Red cherries are good source of water, sugar, protein, fiber, potassium, iron, calcium, magnesium, phosphorus, pro-vitamin A, B1, B6, E vitamin C, vitamin and antioxidant. Firstly, the proximate composition, some vitamin and minerals, non-nutrient compounds and antioxidant compounds were assessed in dry red sweet cherry powder. In the present study, a product was prepared by incorporation of cherry powder. The cookies were prepared in four variants- variant A (5% red cherry powder), variant B (10% red cherry powder), variant C (20% red cherry powder), variant D (30% red cherry powder) and they were examined for sensory acceptability. The most acceptable variant of cookies found was variant C. The proximate composition, mineral and vitamin content, physical evaluations were performed on all the variants. In proximate analysis, cherry powder was found to be rich in protein, carbohydrate, calcium and vitamin C. The cherry powder was low in ash, fiber, fat, iron. In non-nutrients compounds cherry powder was rich in alkaloids and saponins and the powder was low in polyphenol, tannins and flavonoids. The DPPH was rich in cherry powder and metal chelating activity was found low in cherry powder. Then corporate product cookies were found to be rich in moisture, fat, fiber, protein, iron, calcium, total soluble solid, water activity, pH, breaking strength and viscosity. The cookies (A, B, C and D) were found low in carbohydrate and vitamin C content was fully lost in cookies.

Keywords: Antioxidant, phytochemical, cookies, sensory acceptability, physical analysis

Introduction

Scientific classification

Botanical name: *Prunus avium* L.

Common name: Red sweet cherry

Family: *Rosacea* (rose)

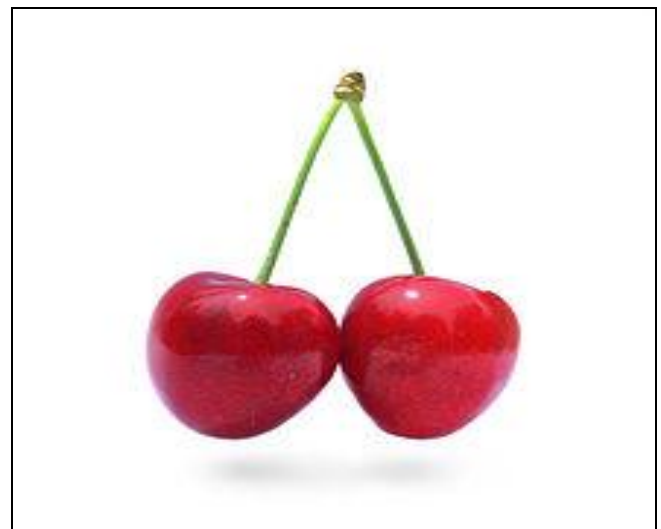
Subfamily: *Prunoideae*

Genus: *Prunus*

Subgenus: *Cerasus* ^[1]

The red cherries are related to *Rosacea* (rose) family and genus *prunus*. The fruit are edible, good texture, delicious taste and nutritional qualities because of these qualities' cherries called super food also. The cherries are eaten by fresh form and processed form like jam, marmalade, pie, fruit juice or canned items ^[2]. Cherries are a prosperous resource of positive antioxidants, flavonoid with anthocyanins, quercetin and kaemferol ^[3] and phytonutrients pigments⁴. *Rosacea* are good source of water, sugar, protein, fiber, potassium, iron, calcium, magnesium, phosphorus, pro-vitamin A, B1, B6, E, vitamin C, vitamin K, antioxidants [melatonin, carotenoids, anthocyanins, flavonols and hydroxycinnamates] ^[5]. Phytonutrients of fruit help to overcome some diseases like gout, arthritis, heart disease, antiaging properties, cardiovascular disease, prevent hypertension, headaches, migraines ^[6], maintaining the human weight, reduce the total body fat specially belly fat ^[7]. *Rosacea* are promoting the repair of muscles and help to relieve muscle pain ^[6], maintain the sugar level in human body, cancer-preventive, increase the free radical scavenging activity and to inhibit xanthine oxidase activity ^[8]. The sweet cherry has been cultivated since ancient times.

The harvest time of cherries is June to July ^[9]. In the world level cherries has grown in so many areas like United States, Iran, Turkey ^[10]. They have been cultivated in southern Australia ^[11].



Morphological Characters

Sweet cherry is a tall tree, branches are erect, leaves are large, thinned pubescent beneath and serrated. The petioles are long having two or more swollen glands. The fruit is cordate in shape, has deep cavity and apex is rounded or pointed. The floral buds are borne on 2-year-old shoot or at the base of 1-year old shoot and found only on lateral,

simple flower buds. Flowers are white in colour and have 5 petals, numerous stamens, single style and an ovary with a single carpel containing two ovules. The fruit color of cherry varies with varieties and may be yellow, red or purplish black. The texture of the flesh is tender or firm, sweet and yellow or red or dark purple in colour^[12].

But the consumption of fruit is low in India. If they are used in different food products their health benefits can be obtained. So, the present study was done to prepare cookies by incorporation of red cherry powder. Nutritive value of cherry powder and cookies was also assessed along with their sensory acceptability.

Material and Methods

Making of cherry powder

Fruits of red sweet cherry purchased from the local market of Ghaziabad. Washed and blanched for 2 minutes then sliced mashed. Cherry pieces were dried by using hot air oven at 60°C for 7 hours. After drying cherry fruit is converting into a powder form by milder grinder. The cherry powder was authentic because its self-made powder through the fresh fruit.

Nutritional composition of red cherry powder

Proximate compounds: Moisture content was determined by hot air oven method^[13], Mineral ash was determined by charring method^[13], Crude fat content were determined by soxhlet method^[13]. Crude fiber content was determined by acid and alkali digestion method^[14], Crude protein was determined by Micro kjeldahl method^[14], carbohydrate was determined by difference method.

Mineral compounds: Iron content was determined by Wong's method^[13]. Calcium content was determined by titrametric method^[14].

Vitamin compounds: Vitamin C were determined by dye (2, 6 dichlorophenol indophenol) titration method^[14].

Non-nutrients compounds: Total polyphenol^[15], alkaloids^[16], tannins^[17], total flavonoids^[18], saponins^[19] were determined also.

Antioxidant capacity: DPPH (1-diphenyl-2-picryl hydrazyl) (For DPPH the standard sample ascorbic acid was used)^[20] and metal chelating activity^[21] was also determine.

Preparation of Cookies

The red cherry powder variants were prepared by incorporating powder at rate of 5%, 10%, 20%, 30% respectively. In a medium bowl all the ingredients- Flour, salt, baking soda, butter, egg and vanilla extract (For the variant samples the red cherry powder was used in the different concentration) were taken. All the ingredients were beat together and prepared dough. Then dough was shaped as a round form and put the dough on the baking sheets and

baked till the edges were golden brown. The cookies baking time is 8-12 minutes and the temperature of the oven are 175 degrees C. Then cool it slightly and stored in airtight container.

Table 1: Ingredients of standard cookies

Ingredients	Amount
All-purpose flour	250.0 gm
Salt	3.5 gm
Baking soda	12.2 gm
Unsalted butter	100.0 gm
Brown sugar	50.0 gm
Egg	110.0 gm
Vanilla extract (for standard sample)	2.0 gm

Nutritional composition of Cookies

In proximate compounds moisture content, mineral ash content, crude fat content, crude fiber content, protein content and carbohydrate content were assessed in all the variants. In mineral content iron content and calcium content was assessed in all the variants. The vitamin C was also analyzed in all the variants.

Physical Analysis: Physical parameters were determined all the samples (standard sample, A variant, B variant, C variant, D variant) -Total soluble solids (TSS) (Refractometer)^[22], Water activity (Thermocouple meter)^[23] and pH (pH meter)^[23], Texture profile analysis- Breaking strength (Stable Micro Systems Texture Analyzer)^[24], Viscosity (viscometer)^[25].

Sensory Evaluation of cookies

Acceptability rating of the products was tested with the help of semi trained panel selected on the basis of threshold and discrimination tests. Twenty panel members were selected by triangle test and directed to judge each sample on the basis of appearance, colour, flavour, odour, texture, mouth feel, over all acceptability and indicate their degree of liking on a nine point of hedonic scale^[26]. The age range of the panel members was between 25-28-year olds and all the panel members are females only.

Statistical Analysis

Data was analyzed with means and standard deviation. Three replications were used for all the analysis.

Results and Discussion

Nutritional and chemical composition of red sweet cherry powder per 100 g is depicted in table 3. The nutritional and chemical composition is as follows, carbohydrate content 91.50±1.10gm/100gm, crude fat content 4.50±0.20gm/100gm, protein content 1.30±0.30gm/100gm, moisture content 1.20±0.60 gm/100gm, mineral ash content 0.70±0.20gm/100gm, crude fiber content 0.50±0.20gm/100gm, vitamin C content 14.20±0.30 mg/100g, calcium content 14.10±0.20 mg/100g, iron content 0.60±0.01mg/100gm. It is reported that 5.91% of proteins, 5.2% fat, 1.80% crude fiber, 4.21% ash contents and moisture content is 81.57%^[27]. Here is the content analysis

of powder 1.06 gm protein, 0.2 gm fat, 16.0 gm carbohydrate, 2.1 gm fiber and 10mg/100g ascorbic acid [28].

Table 2: Nutritional and chemical composition of red sweet cherry powder

Parameters	Result (Mean ± SD)
Proximate analysis	
Moisture (g)	1.20±0.60
Mineral ash (g)	0.70±0.20
Crude fat (g)	4.50±0.20
Crude fiber (g)	0.50±0.20
Protein (g)	1.30±0.30
Carbohydrate (g)	91.5±1.10
Iron (mg)	0.60±0.01
Calcium (mg)	14.10±0.20
Vitamin C (mg)	14.20±0.30
Non-nutrients	
Total polyphenol (mg)	0.10±0.01
Alkaloids (mg)	2.50±0.20
Tannins (mg)	0.06±0.02
Total flavonoids (mg)	0.04±0.02
Saponins (mg)	13.60±0.40

In non-nutrient composition is as follows, saponins 13.60±0.40 mg/100g, alkaloids 2.50±0.20mg/100g, total polyphenol 0.10±0.01mg/100g, tannins 0.06±0.02mg/100g, total flavonoids 0.04±0.02 mg/100 g is depicted in table 3. The other authors finding that, total polyphenol is 1.79 mg/gm, alkaloids 2-6.7 mg/g and total flavonoids are 3.66 mg/g [29].

Table 3: Antioxidant activity of red cherry powder

Antioxidant activity	Results (Mean ± SD)
DPPH (mg)	7.40±0.30
Metal chelating activity	
Ethylenediamine (mg)	0.03±0.01
Porphine (mg)	0.04±0.00
Heme (mg)	0.30±0.10
Dimercap (mg)	0.20±0.10

Table 4: Nutritional composition of cookies

Parameters	Standard	Variant A	Variant B	Variant C	Variant D
Proximate analysis					
Moisture (gm)	8.90±0.07	7.30±1.00	7.80±0.01	8.60±0.20	9.04±0.04
Mineral ash (gm)	0.60±0.20	0.30±0.00	0.50±0.10	0.60±0.17	0.50±0.20
Fat (gm)	23.50±3.30	24.13±0.41	25.33±0.57	26.10±0.10	27.36±0.47
Crude fiber (gm)	5.50±1.10	6.20±1.00	5.00±1.00	5.36±0.33	7.40±0.02
Protein (gm)	13.40±1.30	18.30±1.00	19.20±0.10	20.00±0.04	24.20±0.46
Carbohydrate (gm)	48.10±3.30	43.77±13.30	42.17±1.08	39.34±0.37	31.50±1.37
Iron (mg)	2.70±2.00	2.80±0.30	2.90±0.10	2.90±0.69	3.00±0.04
Calcium (mg)	15.00±2.00	19.00±0.00	21.00±0.50	24.50±1.33	26.30±2.00
Vitamin C (mg)	0	0	0	0	0

The moisture content was increased when the powder was increased in the cookies which are very good. The fat content was also increased in variant A, B, C and D as standard sample. The crude fiber was improved as powder incorporated in high amount (variant D). The protein is also high in variants as compare to standard sample. The crude fiber and protein were important for human body and the cookies were good option to increase the fiber and protein in body. The carbohydrate was decrease in the incorporated cookies which is very good because the carbohydrate is bad when we eat it in excess amount. So, the incorporated cookies contain low amount of carbohydrate as compare to standard sample. The iron content is important for body so

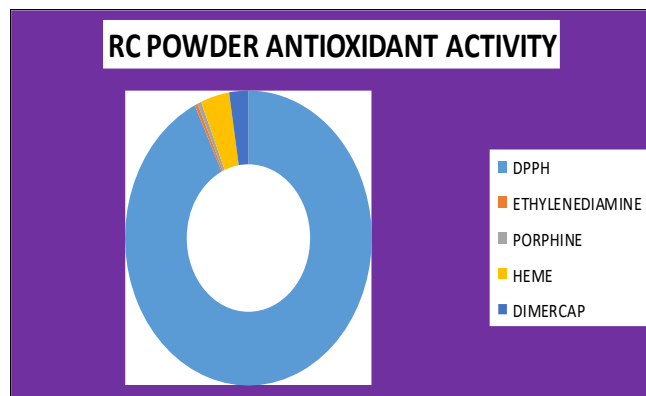


Fig 1: Red cherry powder antioxidant activity and metal chelating activity

In antioxidant activity, DPPH activity was 7.40±0.30mg/100g. Another author finding that, DPPH was 3.86mg/100g [29] and metal chelating activity was Ethylenediamine 0.03±0.01mg/100g, Porphine 0.04±0.00 mg/100g, Heme 0.30±0.10 mg/100g, Dimercap 0.20±0.10 mg/100g. The antioxidant compounds are shown in table 4.

Nutritional and physical characteristics of cookies incorporated with red cherry powder

The nutritional and physical composition of standard cookies is shown in table 5. The standard cookies were found low in protein 13.40±1.30gm/100gm as compared to cookies incorporated with red cherries and variant D cookies were found to contain highest protein content 24.20±0.46gm/100gm. So, the cherry powder helps to increase the amount of cookies protein. In all the variant cookies (A, B, C and D) the carbohydrate was low as compared to standard cookies because the cherry powder was low in the carbohydrate content. The standard cookie was high in carbohydrate 48.10±3.30 and variant D was low in carbohydrate 31.50±1.37.

the variants were increase the iron amount in the variants. The calcium content was also improved in the variants as compared to standard sample. The incorporated cookies were high in crude fiber the cherry powder increase the crude fiber in all the variant cookies and the standard cookies were low in crude fiber. The standard cookies were found low in fat 23.50±3.30gm/100gm and the variant D cookies 27.36±0.47gm/100gm were found high in fat as compared to other cookies. The variant A cookies were found low in mineral ash 0.30±0.00gm/100gm and the standard cookies were found rich in mineral ash 0.60±0.20gm/100gm. The cherry powder was increasing the moisture content of all the variant cookies. The variant D

was high in moisture content $9.04 \pm 0.04 \text{ gm}/100 \text{ gm}$ and standard cookies low in moisture content $8.90 \pm 0.07 \text{ gm}/100 \text{ gm}$. In mineral content the standard cookies were found low in iron content $2.70 \pm 2.00 \text{ mg}/100 \text{ g}$ and variant

D cookies were found high in iron content $3.00 \pm 0.69 \text{ mg}/100 \text{ g}$. In calcium content the standard cookies were found low $15.00 \pm 2.00 \text{ mg}/100 \text{ g}$ and the variant D cookies were found high in calcium content $26.30 \pm 2.00 \text{ mg}/100 \text{ g}$.

Table 5: Physico-chemical properties of cookies

Parameters	Standard	Variant A	Variant B	Variant C	Variant D
Physical analysis					
Total soluble solids (%)	40.10 ± 2.00	43.40 ± 0.00	41.60 ± 1.00	44.50 ± 2.10	45.30 ± 1.13
Water activity (%)	1.30 ± 0.01	1.90 ± 0.05	1.65 ± 0.02	2.83 ± 0.16	2.40 ± 0.40
pH	6.30 ± 0.00	6.90 ± 1.00	6.50 ± 0.00	6.90 ± 1.00	7.00 ± 0.00

In physical activity the standard cookies were found low in total soluble solids content $40.10 \pm 2.00\%$ and variant D cookies were found high in total soluble solids content $45.30 \pm 1.13\%$ (table 6). The variant B cookies were found low in water activity $0.37 \pm 0.02\%$ and the variant C cookies were found high in water activity $2.83 \pm 0.16\%$. The standard cookies were found low in pH 6.30 ± 0.00 and variant D

cookies were found high in pH 7.00 ± 0.00 . The total soluble solid was also improved in incorporated cookies as compare to standard sample. The water activity is increased in incorporated cookies as standard sample. The pH was also good in incorporated cookies and standard sample was low in pH.

Table 6: Textural properties of cookies

Parameters	Standard	Variant A	Variant B	Variant C	Variant D
Texture profile analysis					
Structure	Round	Round	Round	Round	Round
Breaking strength (N/nm^2)	0.22 ± 0.01	0.30 ± 0.01	0.37 ± 0.02	0.40 ± 0.03	0.44 ± 0.04
Viscosity (Pas/Sec)	45.20 ± 0.90	47.70 ± 0.90	46.89 ± 1.00	46.40 ± 1.30	47.40 ± 0.58

The textural properties of standard cookies were found low in viscosity $45.2 \pm 0.9 \text{ Pas}/\text{Sec}$ and variant D cookies were high in viscosity $47.40 \pm 0.58 \text{ Pas}/\text{Sec}$ (Table 7). The standard cookies were found low in breaking strength $0.22 \pm 0.01 \text{ N}/\text{nm}^2$

and variant D cookies were found high in breaking strength $0.44 \pm 0.04 \text{ N}/\text{nm}^2$. The incorporated cookies were good in breaking strength as raise the powder percentage. The viscosity was also improved the variants A, B, C and D as compare to standard sample.

Table 7: Shelf life analysis of cookies

Shelf life analysis	Standard	Variant A	Variant B	Variant C	Variant D
Parameters					
TPC (cfu/gm)	6720	6778	6884	7449	7834
Coliform (gm)	0	0	0	0	0
Yeast&Mould (cfu/gm)	3336	3448	3522	3582	3571

The shelf life also checked of all the incorporated products. The shelf life includes these parameters are- TPC, coliform and yeast & mould. The TPC of standard sample, variant A, variant B, variant C and variant D was 6720, 6778, 6884, 7449 and 7834 cfu/gm respectively. The coliform was absent in all five variants. The yeast & mould was standard sample, variant A, variant B, variant C and variant D 3336, 3448, 3522, 3582 and 3571 cfu/gm respectively. The results show that the shelf life was increased.

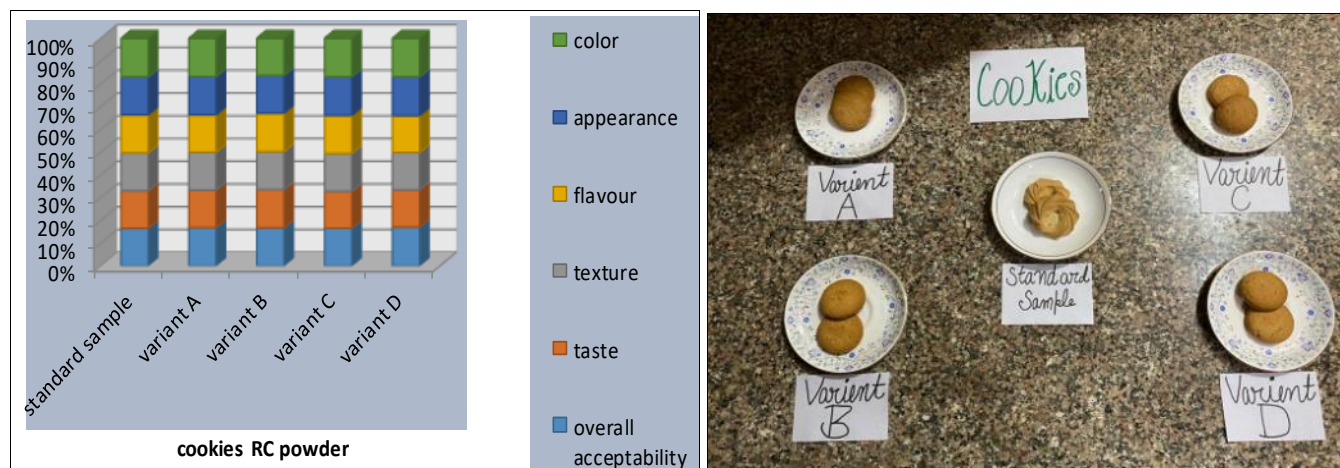
Sensory acceptability of cookies incorporated with red cherry powder

The sensory evaluation of cookies is presented in table 9. Cookies prepared from red sweet cherry powder were rated high in good color of all the cookies. All four variant are good appearance with not lot of significant difference as compared to standard sample. Because as compare to standard sample the other all four variant were also good in color, appearance, texture, taste and overall acceptability. And the standard sample,

cookies appearance was excellent according the sensory evaluation parameters and the variant A, C and D were containing good appearance. The flavor was also good for all the variants. The texture and taste of cookies was good like standard cookies. The overall acceptability of all the cookies was good. But as compare about all the variants (A, B, C and D) variant C was the most acceptable cookies. Variant C was accepted because of the parameters which include in this study (color, appearance, flavor, texture, taste and overall acceptability). The sensory parameters were help to decide the accepted cookies (variant C). Variant C was the best incorporate cookies out of all the four variants. Variant C is best because it is good in attractive color, good appearance, flavor, texture, good taste and it is easily overall acceptable as compare to other three variants A, B and D. The sensory acceptability was based on the parameters and the nutritional and physical characteristics were different. The nutritional and physical characteristics are based on the results which obtained in the study.

Table 8: Sensory evaluation of all cookies

Parameters	Standard sample	Variant A	Variant B	Variant C	Variant D
Color	8.75±0.55	8.15±0.74	8.10±1.02	8.15±0.81	8.10±0.78
Appearance	8.65±0.58	8.15±0.81	8.00±1.21	8.10±0.78	8.10±0.71
Flavor	8.60±0.68	8.10±0.85	8.00±1.21	8.05±0.88	8.20±0.69
Texture	8.60±0.68	8.05±0.68	7.60±1.08	8.00±0.97	8.05±0.94
Taste	8.50±0.88	8.20±0.76	7.80±0.98	8.00±0.97	8.05±0.88
Overall acceptability	8.50±0.99	8.20±0.76	7.95±1.05	8.00±0.97	8.05±0.94

**Fig 2:** Mean values of hedonic acceptability score of cookies incorporated by RC powder

Conclusion

A successful and innovative cookies formulas production with red sweet cherry powder was developed. The consumption of red sweet cherry fruit is able to improve the human health. The fruit is capable to overcome so many diseases like heart diseases, cancer prevention, help to prevent arthritis and gout, diabetes. Additionally, the red sweet cherry powder is able to improve the cookies properties either it is physicochemical or physical. But it could be recommended that using of red sweet cherry should be encouraged in food industries to utilize local raw materials economically to produce high functional food products.

Further Suggestion

- There are some further suggestions or ideas which can be used-
- The fruit (cherries) were also be used in the other studies.
- The other berries were also used in the further studies.
- The products were selected according to their studies which suits or support their study. Like the products were used- other bakery products, toffees, candies, bars, drinks, juices, jams etc.

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