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Development and Nutritional Evaluation of Value Added Baked Products using Strawberry (*Fragaria*)

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ABSTRACT

Traditionally, strawberry fruit has been used as a medicinal agent to nourish the skin and blood, benefits kidney treat weakness, fatigue, anaemia, inflammation and cancer. Strawberry products (cake and biscuits) prepared from fragaria fruit puree are more beneficial because of antioxidant activity attributed to higher anthocyanin and ascorbic acid content. An attempt has been made to develop value added bakery products from strawberry fruits Bakery products like cake and biscuits were developed with three variations each. The products were evaluated for acceptance by semi-trained panellists and results were statistically tested to obtain significant difference between the levels. Cake with 45 per cent of strawberry fruit puree obtained highest score, compared to control. In biscuits, the variation with 30 per cent of strawberry fruit puree obtained highest score. Cake has higher amount of protein, total ash, vitamin C and fibre than biscuits but the highest anthocyanin content was found in biscuits. The storage characteristics were also studied for cake and biscuits which were stored in HDPE bags at ambient conditions (±1°C) and evaluated for sensory evaluation during shelf life showed that the decline in all the sensory attributes as the days increased.

Keywords: Strawberry fruit puree, Bakery products, Sensory attributes, Nutritional evaluation

I. INTRODUCTION

Strawberry plant is a member of the *Rosaceae* family and the genus *Fragaria*. Strawberry varieties around the world are: seascape, Spanish, Camarosa. In India it is generally cultivated in the hills. Therefore, the present study has been taken up to develop commercially viable value added products incorporating fresh fruit puree. The fruit usually wasted can be utilized for preparation of various value added products, which are of commercial importance from the industrial as well as health point of view.

Strawberries are often eaten in variety of ways such as raw as whole, sliced or crushed berries. Strawberries can be processed into crush form which has longer shelf-life.

Strawberries crush was being used because of its highly desirable flavour, sweetness and red colour. The red colour of Strawberries is due to the presence antioxidant anthocyanins. Strawberries are an excellent source of antioxidant i.e. vitamin C and manganese.

Traditionally, strawberry fruit has been used as a medicinal agent to nourish the skin and blood, benefits kidney treat weakness, fatigue, anaemia, inflammation and cancer. It is also used to treat urinary incontinence, tinnitus, dizziness and constipation in elderly and anaemic, because the fruits are rich in vital nutrients and antioxidants especially vitamin C and anthocyanin. The fruits usually wasted can be utilized for preparation of various value added products so an attempt has been made to develop value added bakery products.

II. METHODS AND MATERIAL

The Fragaria fruits were collected from Chandigarh, strawberry fruit based value added product was carried out by incorporating different levels of strawberry fruit puree.

Developed products were evaluated using nine points hedonic scale by 8 to 10 semi trained panel of judges from the Department of Dietetics and Nutrition, M.M.I.C.T. & B.M (Hotel Management), M.M. University, Mullana.

The incorporation of strawberry fruits puree in bakery products was 30 to 60 per cent in cakes and 15 to 45 per cent in biscuits depending upon suitability and tested for acceptance on nine point hedonic scale by semi trained panel of judges.

Two bakery products (cake and biscuits) were tried out using fruit puree form as colouring agent products were tried out using strawberry fruits puree at 30, 45, 60 per cent and 15, 30 and 45 per cent levels was added to cakes and biscuits respectively as a colouring agent and also to enhance anthocyanin content.

The best accepted variation of the product was test for macro and micro-nutrient like moisture, protein, fat, crude fibre, ash and energy (AOAC method), vitamin C (AOAC, 1996) and anthocyanin were analyzed using AOAC method.

To study the shelf life of the bakery products, the best accepted products were packed in High Density Poly ethylene (HDPE) covers, heat sealed and stored at ambient conditions (±1°C). Samples were drawn (every 2^{nd} day for cakes and every 4^{th} day for biscuits) and were tested for sensory attributes. HDPE covers were selected because of high impact strength and good seal-ability character.

III. RESULTS AND DISCUSSION

Two types of bakery products were developed and standardized after incorporating strawberry fruit. Strawberry fruits puree at 30, 45 and 60 per cent levels in cakes and 15, 30 and 45 per cent levels in biscuits respectively as a colouring agent and also to enhance anthocyanin and vitamin C content.

The acceptability scores were based on nine point hedonic scale. Cakes with 45 per cent of fruit puree was scored high. In biscuits, the variation with 30 per cent of strawberry puree obtained high score in (Table 1 and 2).

Table 1: Mean sensory scores of cake

Treatment combination	Colour	Flavour	Texture	Taste	Overall acceptability
C	7.3	7.2	7.4	7.1	7.4
R1	6.9	6.8	7.1	6.9	7.0
R2	7.5	7.3	7.6	7.2	7.5
R3	6.9	6.4	6.4	6.2	6.6
B1	7.2	7.3	6.7	7.0	7.1
B2	7.0	6.7	6.8	6.3	6.7
B3	6.9	6.2	6.6	6.4	6.6
F Value	0.277	0.248	0.722	0.201	0.858
P Value	0.946	0.958	0.633	0.975	0.530
Results	NS*	NS*	NS*	NS*	NS*

*NS = Non significant
Means within a row with different letters are significantly different at $P \leq 0.09$
Means within a column with different letters are significantly different at $P \leq 0.01$
C – Control

R1- Refined Wheat Flour (100%) + Fresh Strawberry Puree 30%
R2 - Refined Wheat Flour (100%) + Fresh Strawberry Puree 45%
R3 - Refined Wheat Flour (100%) + Fresh Strawberry Puree 60%
B1 - Refined Wheat Flour & Barley Flour (50:50) + Fresh Strawberry Puree 30%
B2 - Refined Wheat Flour & Barley Flour (50:50) + Fresh Strawberry Puree 45%
B3 - Refined Wheat Flour & Barley Flour (50:50) + Fresh Strawberry Puree 60%

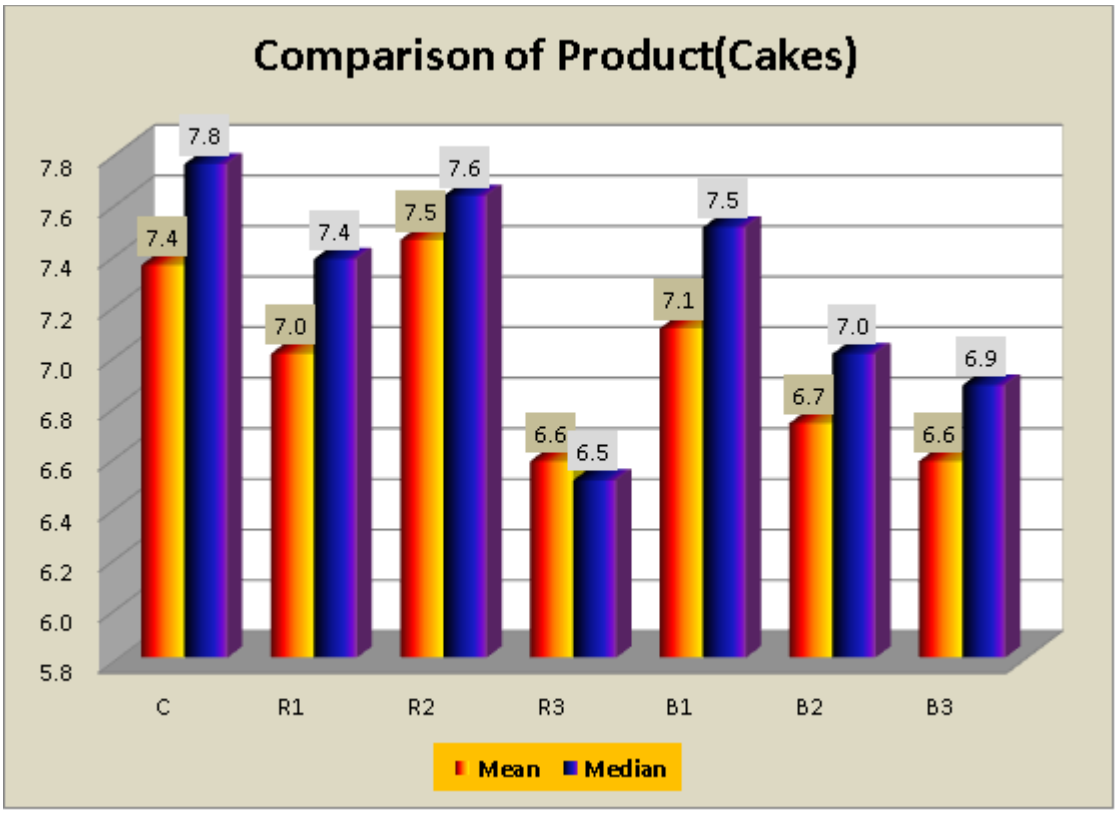

Figure 1. Organoleptic evaluation of strawberry Cakes

Table 2: Mean sensory scores of biscuit

Treatment combination	Colour	Flavour	Texture	**Taste**	Overall acceptability
C	7.8	8.3	7.3	8.3	7.9
W1	7.6	7.1	7.7	7.6	7.5
W2	7.9	7.3	7.5	7.1	7.5
W3	7.9	6.7	6.8	6.8	7.1
S1	7.9	7.5	7.8	7.6	7.7
S2	8.1	7.7	7.6	7.9	7.8
S3	8.0	7.5	7.3	8.1	7.7
F Value	0.191	2.523	1.172	3.041	1.185
P Value	0.978	0.030	0.333	0.011	0.326
Results	NS*	S**	NS*	S**	NS*

*NS = Non significant

**S = Significant

Means within a row with different letters are significantly different at $p \leq 0.04$
Means within a column with different letters are significantly different at $p \leq 0.01$

C – Control
W1 - Refined Wheat Flour (100%) + Fresh Strawberry Puree 15%
W2 - Refined Wheat Flour (100%) + Fresh Strawberry Puree 30%
W3 - Refined Wheat Flour (100%) + Fresh Strawberry Puree 45%
S1 - Refined Wheat & Barley Flour (50:50) + Fresh Strawberry Puree 15%
S2 - Refined Wheat Flour & Barley Flour (50:50) + Fresh Strawberry Puree 30%
S3 - Refined Wheat Flour & Barley Flour (50:50) + Fresh Strawberry Puree 45%

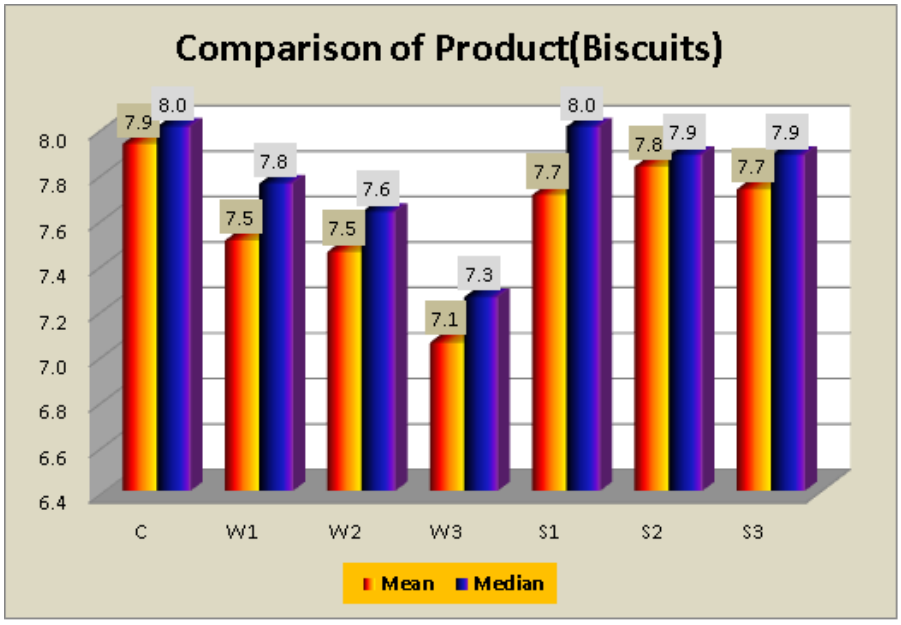

Figure 2: Organoleptic evaluation of strawberry Biscuits

It is evident from Table 3 that nutrient composition of biscuits was found to have high fat and energy than cake. This is because of adding more fat during preparation. Cake has higher amount of protein, total ash and vitamin C than biscuits. This is because of adding higher amount of strawberry fruit puree and addition of milk powder at the time of preparation.

Table 3: Nutrient Composition (100g) of Value Added Products (Cakes and Biscuits) prepared using Fresh Strawberry Puree

Parameters	Cakes	Biscuits
Moisture (%)	32.04	1.11
Fat (g)	6.6	33.6
Protein (g)	15.7	12
Fibre (g)	1.03	0.98
Total ash	0.95	0.74
Carbohydrates (g)	43.7	51.8
Energy (Kcal)	297	558
Anthocyanin (mg)	2.24	3.69
Vitamin C (mg)	23.25	13.81

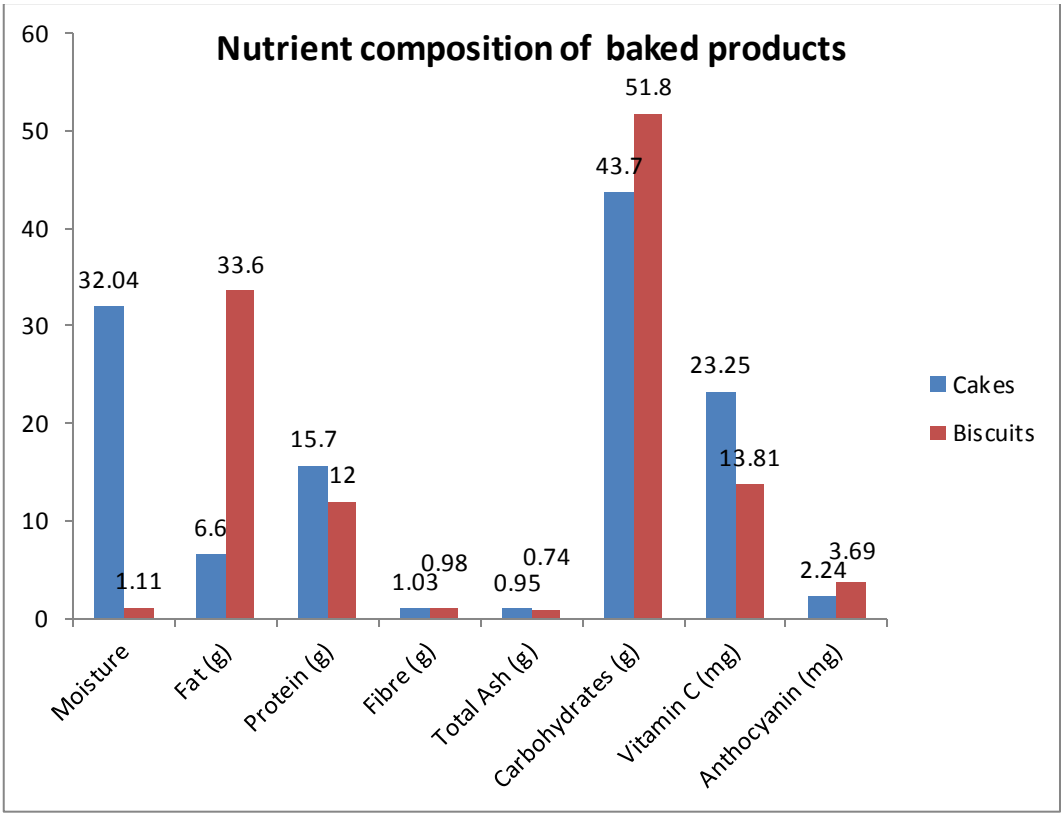

Figure 3 : Nutrient content of baked products incorporated with Fresh Strawberry Puree

The Sensory characteristics of cakes were observed for six days and evaluation was done at 2 days interval. The score reduced as the days increased. The cakes were slightly harder on fourth day and it became stale and dry on sixth day because of loss of moisture (Table 4). The biscuits were kept for 18 days and were observed with 4 days

interval. On 10th day the texture was soft, but there was no change in the taste or other attributes. On 14th day there was slight off flavour and slightly rancid smell was observed. This may be because of high fat content hence the product was discarded. So the results of sensory evaluation showed the decline in all the sensory attributes (Table 5) as the days increased.

Table 4: Mean Sensory Score during Shelf life study of Cakes

Duration (days)	Colour	Flavour	Texture	Taste	Overall acceptability
Initial	7.0	7.7	7.3	7.6	7.5
2	7.0	7.6	7.1	7.4	7.2
4	7.0	7.3	6.3	6.9	6.8
6	6.9	6.9	5.7	6.0	6.3

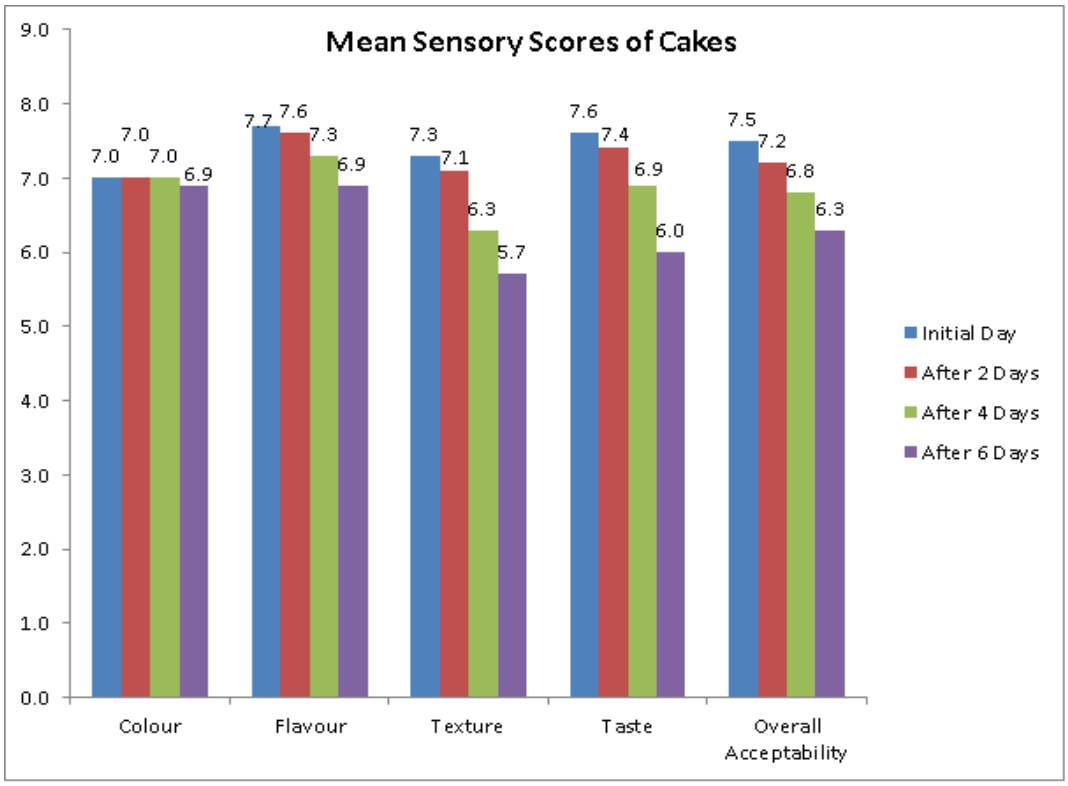

Figure 4 : Mean Sensory Scores during Shelf life study of Strawberry Cakes

Table 5: Mean Sensory Score during Shelf life study of Biscuits

Duration (days)	Colour	Flavour	Texture	Taste	Overall acceptability
Initial	8.2	7.5	8.1	7.5	7.8
5	8.1	7.3	8.2	7.4	7.7
10	7.6	7.4	7.9	6.9	7.4
14	7.2	7.2	7.1	5.8	6.8

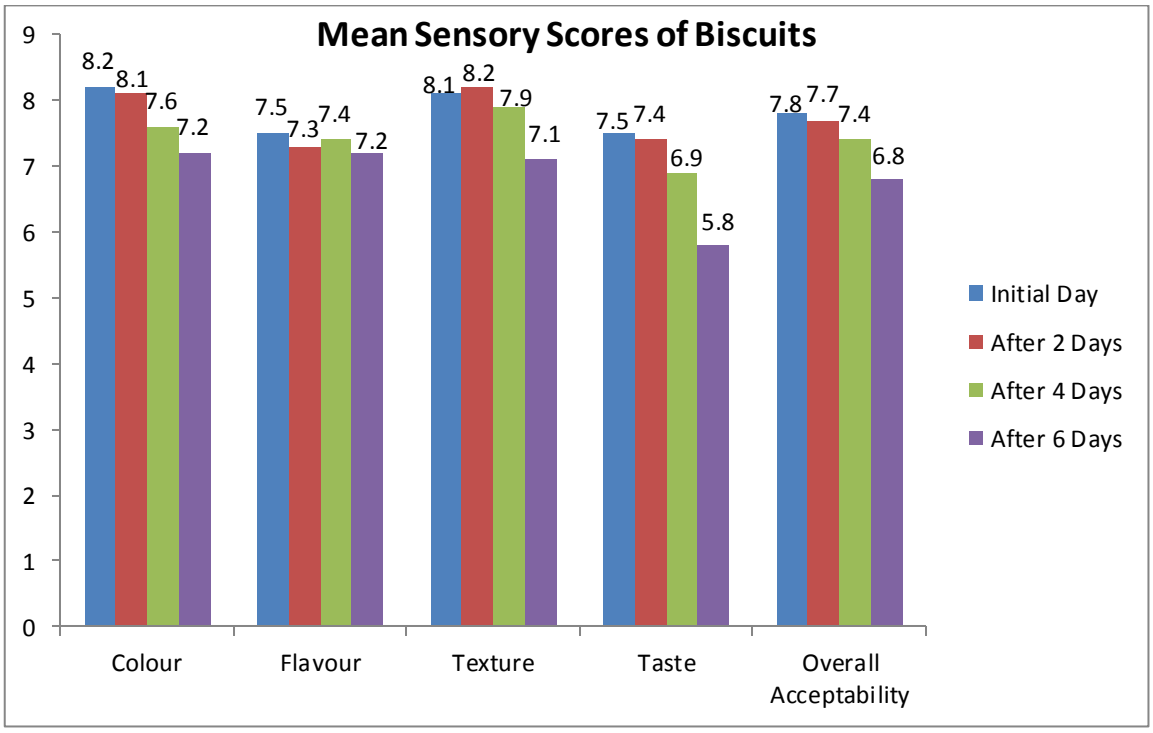

Figure 5: Mean Sensory Scores during Shelf life study of Strawberry Biscuits

IV. CONCLUSION

In Indian diets anthocyanin and vitamin C component is generally low and hence such herbal supplements could be an important source. Strawberry fruit puree, rich in anthocyanins and vitamin C, could be considered as a potential source for production of a natural red food colourant. The value added products prepared by strawberry fruit puree are not available in the Indian market and hence there is a huge potential for commercialisation. The study also reveals that these processed products show good shelf life. At present, cultivation of strawberry fruit could be an additional source of income for farmers.

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