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Sensory evaluation of guava (*Psidium guajava*) leaves powder incorporated bakery products

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Abstract

Guava leaves are rich source of various health promoting micro-and macronutrients as well as bioactive compounds and it has highest waste index. Therefore the present study was undertaken for incorporation of fruits wastes in preparation of bakery products (Masala biscuits and Cupcake). The masala biscuits was prepared by incorporation of guava leaves powder at 2, 4 and 6% level. Cupcake was prepared 2, 2.5 and 3% level of incorporation of guava leaves powder. Masala biscuits and cupcake were evaluated for their sensory characteristics by using five point hedonic scale.

Sensory score of masala biscuits and cupcake revealed that level of incorporation of guava leaves powder had significant effect on sensory properties of biscuits and cupcake. Masala biscuits and cupcake incorporated with guava leaves powder showed decrease in colour, taste score with increase the level of incorporation. It was found that 4% level of incorporation of guava leaves powder in biscuits and 2.5% level of incorporation of guava leaves powder in cupcake had highest sensory score as compared to other level of incorporation.

Keywords: Guava leaves, bakery products, sensory score, incorporation, micro and macro nutrients

Introduction

India is the world's top fruit grower and an agricultural nation. One fruit that is grown on a vast scale is guava. Many other nations with tropical and subtropical climates have developed guava trees, enabling global supply. Guavas grow on a variety of trees and bushes. Guavas have the botanical name *Psidium guajava* and belong to the Myrtaceae genus *Psidium*. In Maharashtra, they are called as Peru and in Hindi, as amrood. In India, Uttar Pradesh, Bihar, Maharashtra, Asam, West Bengal, Haryana, and Andhra Pradesh are the main states where guavas are produced. Allahabad, Safeda, Sardar, Pantprabhat, Lalit, and Khaja are common guava varieties. India produced 4,45 million metric tons of guava in 2021. Guavas can grow up to 10 meters tall. The leaves oval, between 5 and 15 cm long. (Kafle *et al.*, 2008) [8].

The common guava tree (*Psidium guajava* Linn.) is a native of tropical and subtropical regions and is a member of the Myrtaceae family. Fruit from this plant is processed into juice and jam. Folk medicine is another frequent application for *Psidium guajava* Linn. (guava). Aside from these uses, Gutiérrez *et al.* (2008) [7] have reviewed the potential pharmacologic activities of the extract from the fruit, leaf, bark or roots; these activities include antioxidant, hepatoprotective, anti-allergy, anti-microbial, anti-genotoxic, anti-plasmodial, cytotoxic, anti-spasmodic, cardioactive, anti-cough, anti-diabetic, anti-inflammatory and anti-nociceptive activities *in vitro* and/or in animal models. It's interesting to note that guava leaves have gained popularity as a traditional treatment for diabetes not only in Africa but also in Japan and East Asia. According to Akinola *et al.* (2007) [7], the extract of *Psidium guajava* leaves is very significant and can create sperm from infertile males who have oligospermia and non-obstructive a zoospermia. For cardiac ischemia-reperfusion injury, guava (*Psidium guajava*) leaves, which contain the biologically active substances quercetin and gallic acid, are highly helpful. The guava (*Psidium guajava*) leaf extract in aqueous form has a contractile effect, and it is used to lower systemic arterial blood pressure and heart rates. The most efficient secondary metabolites found in guava plants are phenolic chemicals, pentacyclic triterpenoids, flavonoids, quercetin, tannins, and guajaverin. (Lufuluabo *et al.*, 2018) [10].

Because of their flavor and appearance, people of all ages love a variety of bakery goods. Because they are processed foods that are ready to consume, bakery products are gaining popularity day by day. Since there is a good supply of snacks, they are widely accessible. Products from bakeries come in a wide range of kinds. The most popular bakery items are usually cakes. The fact that bakery goods save time is another advantage (Paul, 2012) [11].

Because synthetic antioxidants are toxic and can damage the liver, their use should be restricted. Carcinogenic value. Consequently, the creation and application of safer Natural resources of antioxidants are of curiosity due to the potential drawbacks consequences of artificial food additives on wellbeing of people (Nanditha *et al.*, 2008) [4]. Plant extracts have naturally occurring components of phytochemistry, which have many therapeutic benefits and abroad range of biological functions among them are anti-inflammatory, anti-carcinogenic, and antioxidant, anticoagulant, antimutagenic, antifertility, anti-diabetic, and guava leaves' antimicrobial properties (Wahbha *et al.*, 2021) [15].

By using functional ingredients, the bakery sector now aims to enhance the bakery goods' health benefits. Functional food research is primarily focused on improving gastrointestinal health and immunity, preventing cancer and cardiovascular disease, managing diabetes and insulin sensitivity, improving mental and physical performance, and managing weight. To meet consumers' medicinal needs, bakery products can be fortified in a variety of methods (Dachana *et al.* 2010) [6]. For the nutritional enrichment of bakery products, the protein products and flours of oilseeds, legumes, tubers, other cereals, maize gluten and germ, and rice bran can be employed successfully as sources of vegetable protein. Therefore, the present study planned for development and sensory evaluation of bakery product developed from guava (*Psidium guajava*) leaves powder.

Materials and Methods

The fresh guava leaves were collected from VNМКV University Garden during mansson season and washed well under running tap water to remove all dirt and other foreign material. The leaves were dried into cabinet dryer for 45 minutes. The dried leaves were made into fine powder by grinder machine and stored into airtight plastic jar at room temperature for incorporation purpose.

Preparation of bakery products

The powder of dried guava leaves was incorporated in Masala biscuits at 2, 4 and 6 percent level. Other ingredients were

Refined Wheat Flour, Sugar, Baking Powder, Fat, Curd, Cumin Seed, Green Chilli, Ginger, Curry Leaves, Coriander Leaves, Omum, Salt (table1). For the preparation of masala biscuits refined wheat flour and baking powder were sieved thrice together. Then fat and sugar were creamed together till light and fluffy. Add other ingredients into mixture. Flour was added to creamed fat add curd and make pliable dough. Dough was rolled out and cut into desire shape with the help of biscuits mold. Preheat the oven and baking was done at 180 °C for 20 minutes. Shinde, M (2023) [13].

Table 1: Other ingredients were refined wheat flour, sugar, baking powder, fat, curd, cumin seed, green chilli, ginger, curry leaves, coriander leaves, Omum, Salt

Sr. No.	Ingredients(g)	Amounts			
		Basic	V1	V2	V3
1	Guava leaves powder	0	2	4	6
2	Refined wheat flour	55	53	51	49
3	Sugar	5	5	5	5
4	Fat	20	20	20	20
5	Baking powder	¼ tsp	¼ tsp	¼ tsp	¼ tsp
6	Salt	1	1	1	1
7	Green chilly	2	2	2	2
8	Curry leaves	0.5	0.5	0.5	0.5
9	Coriander leaves	0.5	0.5	0.5	0.5
10	Ginger	0.5	0.5	0.5	0.5
11	Omum	0.5	0.5	0.5	0.5
12	Curd	15	15	15	15

The powder of dried guava leaves was incorporated in Cupcake at 2, 2.5 and 3% level. Other ingredients were Refined Wheat Flour, Sugar, Baking Powder, Fat, Milk powder, Milk, Vanilla essence, (table2). For the preparation of Cupcake refined wheat flour and baking powder were sieved thrice together. Then fat and sugar were creamed together till light and fluffy. Add other ingredients into mixture. Flour was added to creamed fat add milk stir the mixture in one direction up to right consistency for cupcake. Add the mixture into cupcake mold. Preheat the oven and baking was done at 180° c for 25 minutes. Sangle, D (2023) [12].

Table 2: Other ingredients were Refined Wheat Flour, Sugar, Baking Powder, Fat, Milk powder, Milk, Vanilla essence

Sr. No.	Ingredients(g)	Amounts			
		Basic	V1	V2	V3
1	Guava leaves powder	0	2	2.5	3
2	Refined wheat flour	32.5	30.5	30	29.5
3	Sugar	15	15	15	15
4	Fat	12.5	12.5	12.5	12.5
5	Baking powder	0.5	0.5	0.5	0.5
6	Milk powder	15	15	15	15
7	Vanilla essence	Few drops	Few drops	Few drops	Few drops
8	Milk	25	25	25	25

Sensory evaluation of bakery products

Sensory evaluation of guava leaves powder incorporated bakery products were evaluated using five -point Ranking Hedonic Scale (Amerine *et al.*, 1965) [2] to test the level of acceptability for various sensory parameters such as colour, taste, texture, flavour and overall acceptability

Result and Discussion

Sensory evaluation of Masala biscuit developed without and with different levels of incorporation of guava leaves powder: The mean values of Sensory scores for the acceptability of Masala biscuit developed without and with incorporation of guava leaves powder are given in Table 3 and illustrated in Fig. 1.

Table 3: Mean values of Sensory scores of masala biscuit developed without and with different levels of incorporation of guava leaves powder

Variation	Level of incorporation of guava leaves powder (%)	Mean values of Sensory Scores				
		Colour	Texture	Taste	Flavour	Overall acceptability
Basic	0	4.7	4.9	4.9	4.8	4.8 (4.8)
I	2	4.7	4.8	4.6	4.4	4.5
II	4	4.6	4.9	4.7	4.6	4.7
III	6	3.8	4.5	3.5	4.2	4.0

The mean scores for colour of Masala biscuit control and with 2, 4 and 6 percent level of incorporation of guava leaves powder were 4.7, 4.7, 4.6, and 3.8 respectively. The maximum score of 4.7 was obtained by the masala biscuit developed with incorporation of 2 percent of guava leaves powder and masala biscuit developed by without incorporation of guava leaves powder, followed by 4.6 score recorded for Masala biscuit developed with 4 percent guava leaves powder. On the other hand the lowest score of 3.8 for colour was noticed by the Masala biscuit developed with 6 percent level of incorporation of guava leaves powder.

The mean scores obtained for texture of masala biscuit developed with different levels of incorporation of guava leaves powder were found to be between 4.9 and 4.5. The scores obtained for texture of masala biscuit developed without (control) and with 2, 4 and 6 percent level of incorporation of guava leaves powder were 4.9, 4.8, 4.9, and 4.5. Respectively and it was noticed that all the variations were acceptable in terms of texture. The maximum score was obtained by the masala biscuit which was developed with incorporation 4 percent of guava leaves and minimum score was obtained by masala biscuit with 6 percent level of incorporation of guava leaves powder.

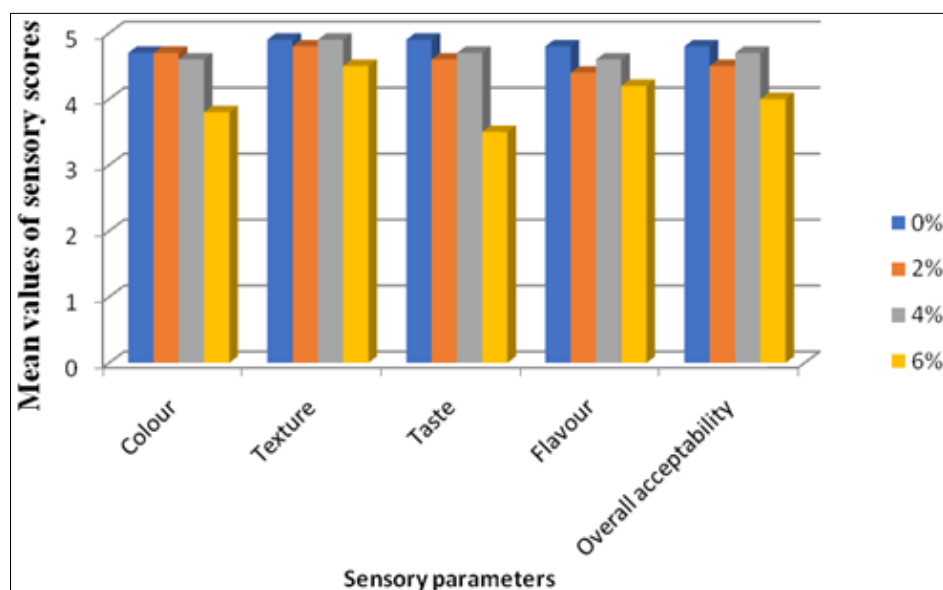
The scores registered for the taste of masala biscuit were 4.9, 4.6, 4.7 and 3.5 for control, 2, 4 and 6 percent level of incorporation of guava leaves powder. The highest score of 4.9 for the taste was recorded by the masala biscuit developed without incorporation of guava leaves powder and lowest score (3.7) for taste obtained by masala biscuits incorporated with 6 percent guava leaves powder. On the whole it can be

concluded that in preparation of masala biscuit developed with 4 percent level of incorporation of guava leaves powder was found to be most acceptable level in terms of taste.

The scores obtained for the flavour of masala biscuit were 4.8, 4.4, 4.6 and 4.2 for control, 2, 4 and 6 percent level of incorporation of guava leaves powder. The maximum score of 4.8 for the flavour was obtained by the masala biscuit developed without incorporation of guava leaves powder and lowest score (4.2) for flavour obtained by masala biscuits incorporated with 6 percent guava leaves powder. On the end it can be concluded that in preparation of masala biscuit developed with 4 percent level of incorporation of guava leaves powder was found to be most acceptable level in terms of flavour.

The mean scores for overall acceptability of masala biscuit control and with 2, 4 and 6 percent level of guava leaves powder incorporation were found to be 4.8, 4.5, 4.7 and 4.0 respectively. The maximum score (4.8) was secured by the masala biscuit developed without incorporation of guava leaves powder (control), followed by 4.7 score which was secured by 4 percent level of incorporation of guava leaves powder and 4.6 score secured by masala biscuit developed with 2 percent incorporation of guava leaves powder while the minimum score 4.0 was secured by the masala biscuit developed by 6 percent level of incorporation of guava leaves powder.

At the end it can be concluded that 4 percent level of incorporation of guava leaves powder in the masala biscuit was found to be most acceptable level in terms of all Sensory characters.

**Fig 1:** Sensory evaluation of Masala biscuit prepared without and with different levels of incorporation of guava leaves powder

Sensory evaluation of cupcake developed without and with different levels of incorporation of guava leaves powder

The mean scores for Sensory characteristics of cupcake

developed without and with different level of incorporation of guava leaves powder are provided in Table 4 and Fig.2.

Table 4: Mean values of Sensory scores of cupcake without and with different levels of incorporation of guava leaves powder

Variation	Level of incorporation of guava leaves powder (%)	Mean values of Sensory Scores				
		Colour	Texture	Taste	Flavour	Overall acceptability
Basic	0	4.6	4.8	4.5	4.7	4.9
I	2	4.5	4.8	4.6	4.5	4.6
II	2.5	4.4	4.8	4.8	4.7	4.7
III	3	3.8	4.0	3.5	3.6	3.6

The scores for the colour of the cupcake developed without and with 2, 2.5, and 3 percent level of incorporation of guava leaves powder were 4.6, 4.6, 4.7, and 3.7 respectively. The highest score (4.7) was obtained by cupcake developed with incorporation of 2.5 percent of guava leaves powder whereas the lowest (3.7) score was secured by cupcake developed with 3 percent level of incorporation of guava leaves powder.

The scores of control, 2, 2.5 and 3 percent level of incorporation of guava leaves powder for the colour of cupcake were found to differ from one another. Statistical analysis revealed that the scores obtained for the colour of cupcake developed with 3 percent level of incorporation of guava leaves powder differed significantly compared with control.

Overall it is conclude that, the different levels of incorporation of guava leaves powder in cupcake, 2.5 percent level incorporation was most accepted with regard to colour.

The mean scores for texture of cupcake developed with different level of guava leaves powder were in the range of 4.8 to 4.6. The scores obtained for texture by cupcake developed without and with 2.5, 5, 7.5 and 10 percent levels of incorporation of guava leaves were found to be 4.8, 4.8, 4.8 and 4.6 respectively. Cupcake developed without (control) and with incorporation of 2 and 2.5 percent level of guava leaves powder scored the same score (4.8) in terms of texture. Whereas minimum score (4.0) was obtained by the cupcake developed with 3 percent level of incorporation of guava leaves powder.

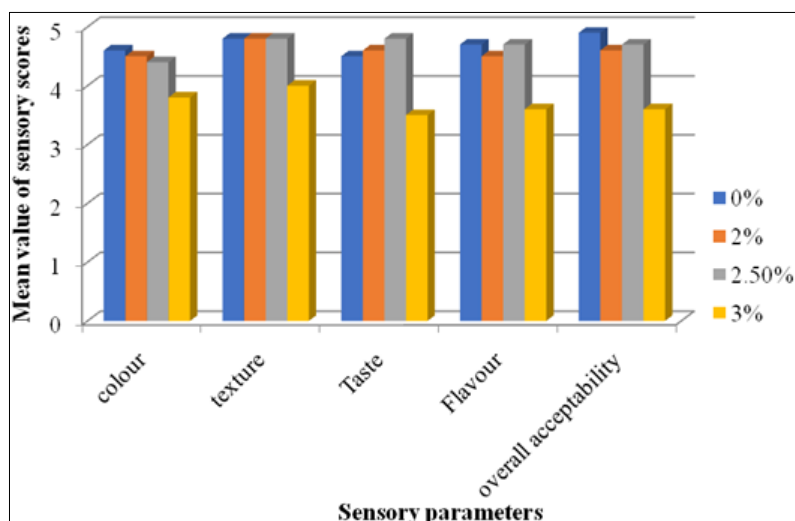
The scores for the taste of cupcake developed without incorporation of guava leaves powder (control) and with 2, 2.5 and 3 percent levels of incorporation of guava leaves powder were 4.5, 4.6, 4.8 and 3.5 respectively. The maximum score of 4.8 was secured by the cupcake developed with 2.5 percent level of incorporation of guava leaves for taste of cupcake whereas cupcake developed with 3 percent incorporation of guava leaves powder obtained the lowest

score (3.7). From the above result it was surmise that the incorporation of guava leaves powder at 3 percent level in cupcake preparation affected taste significantly as compared to control. It was concluded that cupcake developed with 2.5 percent incorporation of guava leaves powder was more acceptable with regard to taste.

In case of flavour of cupcake developed without incorporation of guava leaves powder and with different levels of incorporation of guava leaves powder the scores ranged from 4.7 to 3.6. The highest score (4.7) for the flavour was obtained by cupcake developed without (control) and with 2.5 percent level of incorporation of guava leaves powder while lowest value (3.6) was obtained by cupcake developed with 3 percent level of incorporation of guava leaves powder. The scores obtained by 2, 2.5 and 3 percent level of incorporation of guava leaves powder for flavour of cupcake were 4.5, 4.7 and 3.6 respectively.

The mean value for overall acceptability of cupcake developed with different levels of incorporation of guava leaves powder was ranging from 4.7 to 3.6. The maximum score (4.7) was obtained by cupcake developed with 2.5 percent level of incorporation of guava leaves powder, whereas, minimum score (3.6) was secured by the incorporation of 3 percent level of guava leaves powder. The score for overall acceptability of cupcake developed with 2.5 percent level of incorporation of guava leaves powder was more than that of developed with 3 percent level of incorporation of guava leaves powder. It can be concluded that other than other variations cupcake developed with 2.5 percent of guava leaves powder incorporation was more acceptable with regard to overall acceptability.

On the whole, it can be concluded from the above tabulated data that up to 2.5 percent level of incorporation of guava leaves powder in the preparation of cupcake was found to be acceptable level for all the sensory parameter like colour, taste, flavour and overall acceptability.

**Fig 2:** Sensory evaluation of Cupcake developed without and with different levels of incorporation of guava leaves powder

Conclusion

The present study concludes that incorporation of guava leaves powder up to 6 percent was found to be acceptable in masala biscuits and 3 percent was found to be acceptable in cupcake sensory score revealed that the acceptability ranged from slightly acceptable to most acceptable. Guava leaves powder can be incorporated into different food products for improving nutritional and sensory qualities of food products.

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