A study on standardization of value-added products of fig fruits grown in Ballari District of Kalyana Karnataka

ABSTRACT:

The fig fruit, *Ficus carica* L., (Moraceae family) is one among the major fruit crops grown in Ballari district of Kalyana Karnataka. Due to rapid respiration rate and significant ethylene production fruits are climacteric and extremely perishable. Among the three varieties namely Ballari, Daenna, and Turkey brown are grown in Ballari District, Ballari variety covers larger area. Although growing fig is a year-round farming activity in the region, there are just a few fig processing technologies available to adopt. ICAR-Krishi Vigyan Kendra, Ballari conducted a study to develop novel value-added products using fig varieties grown in the district. Processes to make dry fruit fig burfi and fig-banana rolls were standardised and nutritional value of the standardised products were analysed. The results showed fig dry fruit burfi made from Ballari variety having high protein (12.78g), calcium (17.45mg) and iron (6.0mg) content compared to other two varieties. Fig banana rolls made from Ballari variety also showed higher total mineral content (2.06g), fibre (1.62g), protein (0.70g) and carbohydrates (81.26 g) compared to other two varieties.After 60 days of storage, an organoleptic evaluation and microbiological analyses were carried out. Dry fruit burfi and fig-banana rolls made from Ballari variety were shown to be more nutrient-dense and performed better in organoleptic test when compared to those made with other varieties. Microbial loads test after 60 days of storage period showed the total plate counts below the permissible IFSA (International Flight Services Association) requirements for fig burfi and fig banana rolls made of all the three varieties. None of the products had any mould or yeast. The study revealed the value added products made from Ballari variety fig are more nutritious than that made with other two varieties grown in the district.

KEYWORDS: fig rolls, burfi, shelf life, organoleptic evaluation

INTRODUCTION:

Fig (*Ficus carica*) is one of the oldest known and first cultivated fruit trees in the world. Fig belongs to the mulberry family Moraceae and is containing 800 tropical and subtropical plant species. It is also known as ‘Anjir’ in Asia, ‘Fiege’ in German, ‘Figue’ in French and ‘Higo’ in Spanish.

In India, its cultivation is mostly confined to western parts of Maharashtra (Pune) and Gujarat, Uttar Pradesh (Lucknow and Saharanpur), Karnataka (Ballari, Chitradurga and Srirangapatna) and Tamil Nadu (Coimbatore) [1]. The fig, often known as the "fitness fruit," is one of the most significant medicinal fruits that can be found anywhere in the globe. Fig can be grown in more humid settings, such as the tropics and subtropics, but it is especially well suited to Mediterranean climates with cool winters and hot, dry summers. Once established, fig is very drought tolerant, and dry, hot summers are preferable for commercial production. However, fig requires frequent irrigation to produce higher yields.

Over 5600 hectares of land are used for fig farming in India, producing 13.802 thousand tonnes annually, or 12.32 tonnes per hectare. According to the annual report of Karnataka State Department Agriculture, Ballari for the year 2019-20, 1800 hectare area is under fig fruit cultivation in the district producing 14,087.83 metric tonnes and yielding 7.82 tons/ha. One of the main fruit crops grown in Kalyana Karnataka's Ballari district is the fig. A locally cultivated fig called "Ballari variety" is one among the few varieties grown across India. It has high market demand because of its superior quality, sweetness, and colour when compared to other varieties, and is available all through the year.

Figs often have a sweet flavour and a chewy texture. Figs are highly prized in both their fresh and processed forms because they are a repository of vital nutrients and phytochemicals that are rich in antioxidants. Figs are a great source of antioxidants and phenolic chemicals [2]. Daenna and turkey brown varieties of fig are grown in this region. Due to popular customer demand from all over Southern India, the Ballari variety is more prevalent than the other two. Although growing figs is a year-round farming activity in the region, there are just a few fig processing technologies that can be used. In order to develop fresh value-added products from locally grown fig types, the current experiment was undertaken.

MATERIAL AND METHODS:

ICAR-KVK, Ballari, conducted the study by collecting the fruits from the farmer fields in Kurugodu Taluk of Ballari district. The firm and fully grown fig fruits of three varieties-Ballari, Turkey Brown, and Daenna were procured. In the laboratory investigations, analytical-grade chemicals were employed, while other raw materials were purchased at the neighbourhood market.

Optimization of procedure for making standardized fig products:

Process for producing two products, fig dry fruit burfi and fig-banana rolls, were standardised, enabling for process optimization. Necessary ingredients were procured from the local market. The three fig fruit varieties were washed separately, manually de-stemmed, and cleaned of debris before being prepared for processing. The production method for two value-added goods, fig dry fruit burfi and fig-banana rolls, were optimized. Using various varieties of figs cultivated in the area, the fig products were made in three variations.

The flowcharts for the preparation of fig dry fruit burfi and fig banana rolls are shown in Fig. 1 and Fig. 2, respectively.

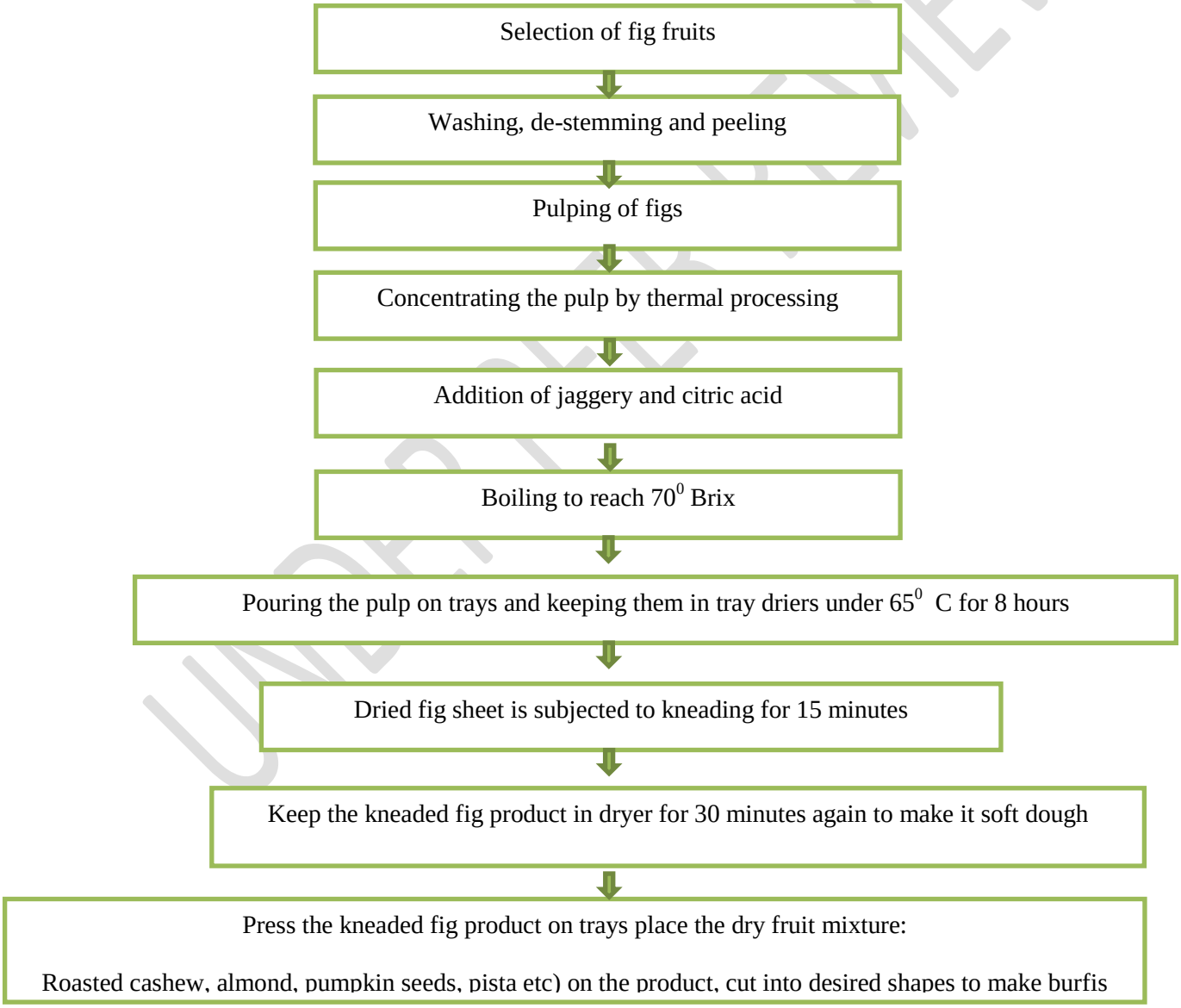

Fig 1: Schematic diagram of the process for the production of the fig dry fruit burfi

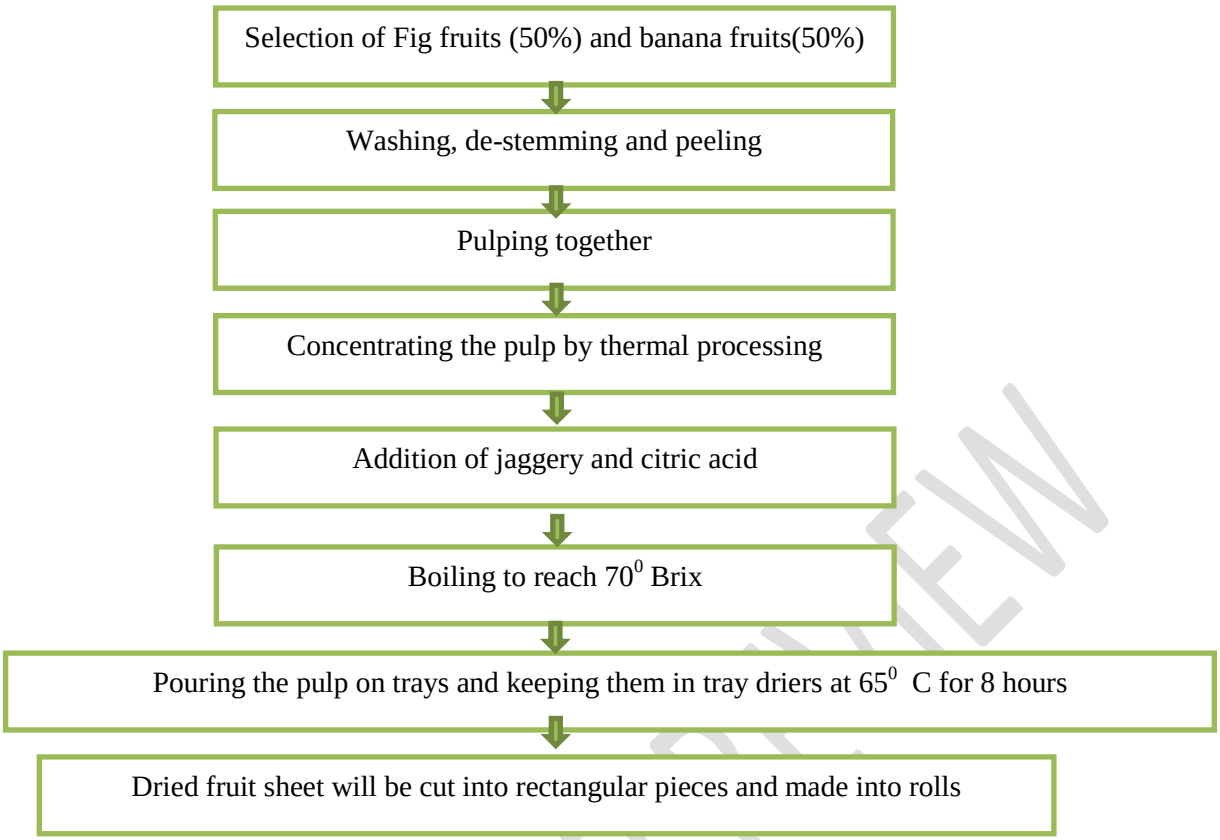

Fig 2 : Schematic diagram of the process for the production of the fig-banana rolls

Analysis of the nutritional value of fig products:

The standardised fig products were tested at the Pesticide Residue and Food Quality Analysis Laboratory, UAS, Raichur for moisture, total minerals (g), fat, fibre, protein, carbohydrates, calcium, and iron using the AOAC, 2000 methods [3].

Organoleptic evaluation of the standardized products:

A panel of 21 semi-trained judges conducted an organoleptic study of fig products. A 9-point Hedonic scale was used to evaluate the sensory characteristics, including appearance, taste, flavour, texture and overall acceptability [4].

Studies on the shelf life of the standardised products: The standardised fig products were tested for their sensory qualities every 30 days over the course of three months. The products were also put through storage tests for 60 days at room temperature. Using established microbiological techniques, the total plate count, mould count, and yeast count were performed on the first day and on the 60th day of storage.

RESULTS AND DISCUSSION

Among the confectionery, burfi is one of the most popular khoa-based sweet all over the country. The generic nomenclature "burfi" covers a wide range of product variations that include plain, danedar, dudh, chocolate, fruit and coconut burfi [5]. Typically, it has a mildly caramelized and pleasant flavour. Multi-layered and multi-coloured varieties are also produced. In our study, the burfi is made with fig, dry-fruits and jaggery. Fruit leathers/rolls are dehydrated fruit based products and are tasty, chewy, dried fruit products. They are prepared by pouring pureed fruit onto a flat surface for drying. When the dried fruit is pulled from the surface and rolled it gets the name of leather, from the fact that when the pureed fruit is dried, it is shiny and has texture of 'leather'[6].

In the present study, we have developed the process of making fig dry fruit burfi as well as fig-banana rolls (leathers) individually. The nutritional analysis of developed fig products was carried out in triplicates and average values are presented in Table 1.The results of nutritional value of fig dry fruit burfi and fig- banana rolls made from three different varieties of fig fruits showed non-significant differences. The reason for slight differences in the results may be due to the differences in the nutritive value of the fig fruit varieties used, whereas the nutritive value of the banana and the dry

fruits used remained same. Fig dry fruit burfi made from Ballari variety showed higher protein (12.78g), calcium (17.45mg) and iron (6.0mg) content compared to other two varieties whereas Deanna variety burfi showed better fat (0.65g) and fibre content (4.99g).

Table 1. Nutritive value of fig dry fruit burfi and fig-banana rolls developed from different varieties of figs grown in the district (per 100 g)

Nutrients	Fig dry fruit burfi			Fig-banana rolls		
	Deanna	Ballari Variety	Turkey brown	Deanna	Ballari Variety	Turkey brown
Moisture (%)	10.30 a	10.13 a	11.21 a	10.62 a	10.11 a	11.08 a
Total minerals (g)	2.09 a	1.98 a	2.06 a	1.93 a	2.06 a	2.10 a
Fat (g)	0.65 a	0.57 a	0.62 a	0.06 b	0.05 b	0.06 b
Fibre (g)	4.99 a	4.91 a	3.86 b	1.44 c	1.67 c	1.62 c
Protein (g)	3.21 a	2.78 a	3.32 a	0.17 d	0.70 b	0.50 c
Carbohydrates (g)	70.18 a	80.11 a	80.79 a	76.22 a	81.26 a	81.24 a
Energy (K cal)	299.0 b	373.0 a	354.0 a	306.0 b	328.0 ab	331.0 ab
Calcium(mg)	15.92 a	17.45 a	15.37 a	15.0 ab	14.2 b	14.4 b
Iron(mg)	2.70 c	6.0 a	4.5 a	4.64 a	3.58 b	4.25 ab

Values in lined with similar letters do not differ significantly according to Duncan test at $p<0.05$

The results of the t-test for fig dry fruit burfi indicate that there is a statistically significant difference in the mean values of the nutritional data between Deanna fig dry fruit burfi and Ballari Variety fig dry fruit burfi (p-value 0.74). However, there is no statistically significant difference in the mean values of the nutritional data between samples Deanna fig dry fruit burfi and Turkey brown fig dry fruit burfi (p-value 0.13), or between samples Ballari Variety fig dry fruit burfi and Turkey brown fig dry fruit burfi (p-value 0.21).

The results of the t-test for fig banana rolls indicate that there is a statistically significant difference in the mean values of the nutritional data between Deanna fig banana rolls and Ballari variety fig banana rolls (p-value 0.74). However, there is no statistically significant difference in the mean values of the nutritional data between Deanna fig banana rolls and Turkey brown fig banana rolls (p-value 0.13), or between Ballari variety fig banana rolls and Turkey brown fig banana rolls (p-value 0.21).

However, fig banana rolls made from Ballari variety showed higher total mineral content (2.06g), fibre (1.62g), protein (0.70g) and carbohydrates (81.26 g) compared to other two

varieties.The number of consumers who are aware of nutritional and functional foods is increasing. Customers want to consume safe foods that provide additional benefits alongside their nutritional value. However, customers are more inclined to buy these functional foods due to positive health benefits. Furthermore, people are becoming increasingly interested in functional foods [7].

The characteristics of functional foods are thought to be high levels of protein, fiber and the total phenolic content [8]. The nutritious qualities found in fruits and vegetables are responsible for this effect [9]. These are a great source of phenolic compounds, minerals, amino acids and vitamins [10]. Dried figs have ability to potentially promote health due to the presence of high levels of polyphenols [11].

A study in the year 2022 revealed that the dried fruit of fig has carbohydrates as a major component (73.50%) that corresponds to its high energy value (317.78 kcal), very low amount of fat (0.56%), a moderate amount of protein (4.67%) while dietary fiber content was (3.68%) [12]. Fig contains both soluble and insoluble dietary fiber that has a number of health benefits. Thus the developed fig banana rolls and fig dry fruit burfi are excellent source of energy. In another study [13] the chemical composition of the dried fig was found to be about 69.1 % of polysaccharides, 4.3% protein; 2.46% fat, 12.1% carbohydrate and 3.1% ash. Researcher in a study quoted that both fresh and dried figs have high amounts of fiber and polyphenols. Figs are found to be a rich source of amino acids [14] . A study on nutritional value of fig powder incorporated burfi the results showed the burfi was rich in fiber (3.7 %), potassium (0.464 %) and protein (13.12 %) [15].

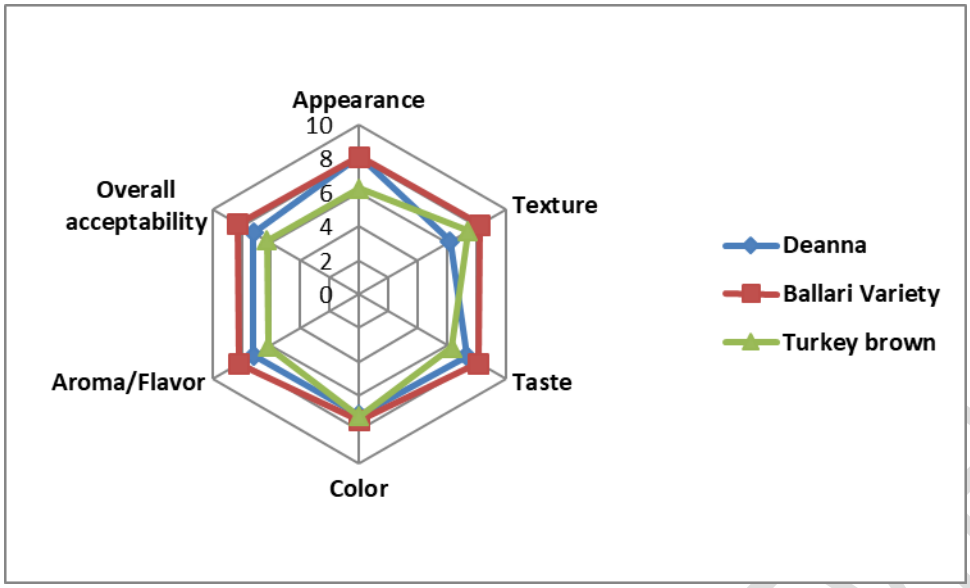

Fig 3: Mean scores of Organoleptic evaluation of fig dry fruit burfi developed from different varieties grown in Ballari district (N=21)

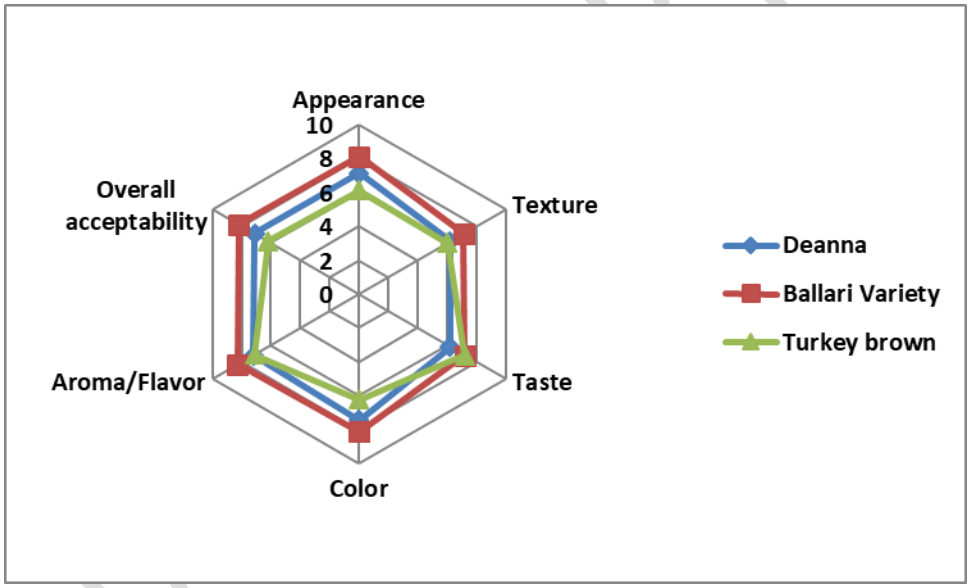

Fig 4: Mean scores of Organoleptic evaluation of fig-banana rolls developed from different varieties grown in Ballari district (N=21)

Organoleptic evaluation proved that fig dry fruit burfi (Fig 3) made from Ballari variety has scored more for all the parameters of sensory evaluation like appearance, texture, taste, color, aroma, overall acceptability compared to burfi made from other two varieties. Fig banana rolls (Fig 4) made from Ballai variety has scored more in overall acceptability and other parameters of sensory

evaluation. The reason could be higher TSS content of the fruits (22.8%). Another similar study showed that organoleptically best quality fig toffee can be obtained with the formulation containing 100 g fig powder, 220 g sugar, 35 g SMP, 32 g vegetable fat and 32 g liquid glucose [16].

It is worth noting that the texture of fruit leathers can be evaluated in several ways. The human mouth is more complex at evaluating the texture as opposed to a penetrometer which might measure just one aspect of texture [17][18].

The sensory evaluation of mixed fruit leathers and the results showed that fruit lather made form mixed fruits is significantly better in taste, taste score of the Sample average 7.25 whereas for color it was 7.0 [19].

Table 2: Microbial load of fig burfi and fig-banana roll samples after a storage period of 60 days

Products	Varieties	Name of the test	Microbial load on initial day of storage (cfuXdf)	Microbial load After 60 days of storage (cfuXdf)
Fig dry fruit burfi	Deanna	Total plate count	Nil	10.2×10^2
		Mould and yeast count	Nil	Nil
	Ballari Variety	Total plate count	Nil	8.94×10^2
		Mould and yeast count	Nil	Nil
	Turkey brown	Total plate count	Nil	4.63×10^2
		Mould and yeast count	Nil	Nil
fig + banana rolls	Deanna	Total plate count	Nil	8.2×10^2
		Mould and yeast count	Nil	Nil
	Ballari Variety	Total plate count	Nil	7.9×10^2
		Mould and yeast count	Nil	Nil
	Turkey brown	Total plate count	Nil	5.63×10^2
		Mould and yeast count	Nil	Nil

The microbial safety of any food product is very important aspect especially if the product is intended to be stored for long time. The results of shelf life studies showed no total microbial load on day-1 of the developed products. Whereas upon 60 days of storage fig dry fruit burfi and fig banana rolls made from all the three varieties of figs showed presence of

microbial load but they were within the range of IFSA (International Flight Services Association) permissible limits of 10^6 for food samples. A study was conducted to know the storage stability of guava leather in two different packaging materials like biaxially oriented polypropylene and punnets. Microbial analysis showed the leathers were safe for consumption till 4 months of storage in both packaging [20]. A study showed that the microbial quality viz., yeast and mould count were found to be increased during 180 days of storage in fig leather but was found to be within acceptable levels [5].

Conclusion:

From the present study it was concluded that varieties of fig (*Ficus carica*) namely Ballari variety, Daenna, and Turkey brown grown in Ballari district of Kalyana, Karnataka are popular in Southern India. KVK, Ballari conducted a study to develop value-added products from all the varieties and evaluated for their suitability and consumer preference. Process for making fig-banana rolls and fig dry fruit burfi have been optimized. The Ballari variety produced more nutrient dense and organoleptically best fig dry fruit burfi and fig-banana rolls. All the products developed from three varieties of figs had microbial loads below the IFSA requirements.

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