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Development of fig fruit *(Ficus carica* L.*)* based jam products and evaluation of sensory attributes

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Abstract
Fig fruit *(Ficus carica L.)* based jam variety were developed by using fig fruits such as fresh and dried figs respectively with the objective of evaluation of sensory attributes. Two types of jam variety were developed by using fresh and dried figs respectively. Sample-A is Fresh fig jam and Sample-B is Dried fig jam. The sensory attributes such as colour, taste, appearance, flavour and consistency were evaluated by ten panel members. Overall acceptability was also determined. Sample-A (Fresh fig jam) obtained highest score for all the parameters evaluated. The overall acceptability of Sample-A is 8.62 ± 0.29 and Sample-B is 8.02 ± 0.42. Research findings could be used in food preservation, the developed products can be available during off season also, which will increase the consumer acceptability and demand thereby reducing post-harvest losses.

Keywords: fig fruit, jam, sensory attribute, food preservation, acceptability

Introduction
Fig fruits (*Ficus carica L.)* are one of the oldest cultivated plants, which can be consumed as fresh or dried. Figs are popular not only because of their pleasant taste, but possibly because of their nutritional benefits on health. Based on variety the colour of figs may vary from purple to green (Solomon *et al*., 2006) [15]. The consumption of figs has positive health effects due to the presence of nutraceutical compounds. The dried and fresh figs are reported to be a good source of dietary fibres, vitamins, minerals and phenolic compounds (Veberic *et al*., 2008) [17]. Fig fruits are important source of biochemically active compounds, which has potential role in the prevention and treatment of various diseases such as nutritional anemia, cancer, diabetes mellitus, liver disorders, skin disorders and stomach ulcers (Debib *et al*., 2014) [3].
Fresh figs are available only during the season. The shelf life of fresh figs are short, usually the post-harvest life will be 7 to 10 days. Fresh figs are highly sensitive to physiological changes, physical and chemical damage and susceptible to post-harvest losses. Pre-harvest and post-harvest measures are very important to improve the quality and post-harvest life. A combination of cooler conditions and a modified atmosphere packaging can extend storage life for up to 2 - 4 weeks. The popular approach for preserving figs is through jam processing (Konak *et al*., 2017) [15]. Food preservation methods extend storage life and helps better distribution and utilization during off season both in large scale and home scale. Fruits are perishable commodity and also available during specific season, so they are processed into food products such as jams, jellies, marmalade, squashes, juices and pickles to make available during off-season also (Ajenifujah - Solebo *et al*., 2011) [1]. Jam is a processed food product having an intermediate moisture content which is prepared by using fruit pulp, sugar and acid. Preservatives, flavouring or colouring compounds are added as food additives. Pectin plays an important role in the preparation and quality of jam. Pectin is a type of fiber and it is a key ingredient in the composition of jam. For the preparation of good quality jam, the fruit should contain adequate amounts of pectin or pectin is added in required amounts (Shah *et al*., 2015) [13]. The consistency of good quality jam should be easily spread and should be firm enough so that it does not flow like a fluid. Jam composition should be approximately with at least 68.5% total soluble fruit solids and the fruit should supply at least 45% of the total weight of jam. The composition of sugar present in jam reduces its water activity, acts as a preservative, resulting in improved shelf life. Good quality jam is made up of soft even consistency without distinct pieces of fruit, a bright colour, with fruit flavour and a semi-jellied texture that is easy to spread but not as a free liquid. A great advantage in the preparation of jam is it can be prepared in a single operation (PFA, 2004). This study was carried out with the objective of development of fig fruit based jam products and evaluation of sensory attributes.

Materials and Methods
Selection of figs
Both fresh figs (Figure 01) and dried figs (Figure 02) used for the research work were purchased from local market, Thiruchirrapalli district, Tamil Nadu, India.

Fig 1: Fresh figs

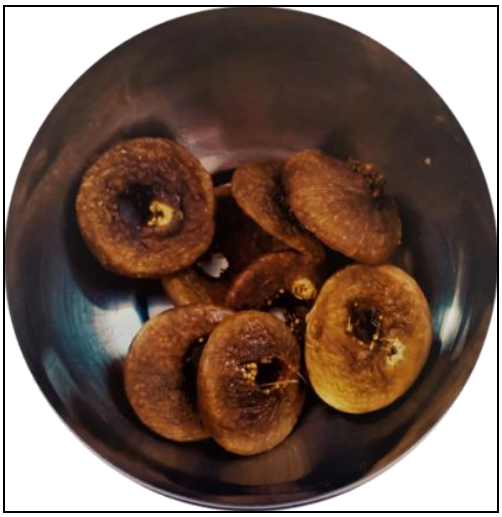

Fig 2: Dried figs

Preparation of jam

The fresh fig fruits were washed manually to remove any dust or foreign particles on their surface and chopped manually into small pieces. Then the fruits were ground individually using a mixer grinder (GX6 Mixer Grinder, Bajaj Electricals Limited, Mumbai, India) till the pulp becomes uniform and homogeneous (Shah *et al*., 2015) [13]. The ground pulp was then strained through a stainless steel strainer (100 mesh). Then 300ml of water is measured and added to 250g of sugar to prepare sugar syrup. For the preparation of sugar syrup, boiling method was adopted at 100 °C and 5ml of lemon juice was added, and allowed to boil until a gel was formed. The prepared syrup was added to 200g of the fruit pulp, allowed to cook on constant boiling and stirring. The temperature and time were recorded. At the end, the prepared jam was carefully poured in a sterilized glass bottle and was allowed to cool (AOAC, 2006).Fresh fig jam (Figure 03) is termed as Sample-A and Dried fig jam(Figure 04) is denoted as Sample- B.

Fig 3: Fresh fig jam

Fig 4: Dried fig jam

Sensory Evaluation

The term "sensory evaluation" indicates a complete analysis of the various properties of food as perceived by human sense. Sensory evaluation plays a vital role in food product development and evaluation of consumer acceptability (Iwe, 2002) [4]. In this study sensory attributes of developed products were evaluated by randomly selected panel members comprising ten number of panel members. They assigned scores for colour, taste, appearance, flavour and consistency. Overall acceptability was also determined. Sensory evaluation was done by using 9-point hedonic scale as tool, by selected panel members. The tasting panel consisted of 10 members. The tool used for the evaluation of sensory attribute, Hedonic rating scale is given in Table 01. The preferences indicated as scores were evaluated by standard statistical methods. The overall acceptability was also evaluated.

Table 1: Hedonic Rating scale

Comments	Scoring Parameter
like extremely	9
like very much	8
like moderately	7
like slightly	6
neither like nor dislike	5
dislike slightly	4
dislike moderately	3
dislike very much	2
dislike extremely	1

Analysis of nutritional composition

For Sample-A and Sample-B nutritive value was calculated by using Food composition table as reference standard value (Longvah *et al*., 2017) [7].

Statistical analysis

Sensory scores of different parameters were expressed as mean ± standard deviation (X±SD). t - test ($p<0$ 05) was used to determine the significant differences between mean values of sensory attributes.

Results and Discussion

Sensory attributes of prepared jam variety

Jams are made by using ingredients such as sugar, pulp, and/or puree from one or more types of fruit, water, and pectin. Colour is a prime parameter in the evaluation of quality of jams. This parameter is fundamental for the consumer acceptance or rejection of the product. The colour of the prepared jam products are affected by pH, ions, temperature, light, oxygen, enzymes, sugars and storage conditions. The texture also affects the final assessment of the product quality. Improper texture can make the product unacceptable to the consumer, even if it tastes very good (Levaj *et al*., 2010). Previous findings confirm that jam consistency depends on the amount and type of fruit pulp, sugar and pectin content. Pectin is the main factor determining the consistency of jam and have an effect on gel texture and spreading quality (Marina Paolucci *et al*., 2020).

Sensory attributes measured for the prepared jam variety were colour, taste, appearance, flavour and consistency. The scores are depicted in Table 02. It could be observed from Figure 05, the Sample-A(Fresh fig jam), had the highest mean scores for all attributes being compared with Sample B. The overall acceptability of Sample -A is 8.62 ± 0.29 and Sample -B is 8.02±0.42. The result showed that there were no significant difference between Sample-A and Sample-B.

Table 2: Sensory attributes of prepared jam variety

Sample	Colour	Taste	Appearance	Flavour	Consistency	Overall acceptability
Sample -A	8.6 ± 0.66	8.6±0.48	8.8±0.4	8.4±0.663	8.7 ±0.4583	8.62 ± 0.29
Sample -B	8.4±0.489	7.8±0.87	7.3±0.964	8.3±1.009	8.3±0.458	8.02±0.42

Values in the table are presented as mean ± SD; the calculated t -value is significantly different (P>0.05)

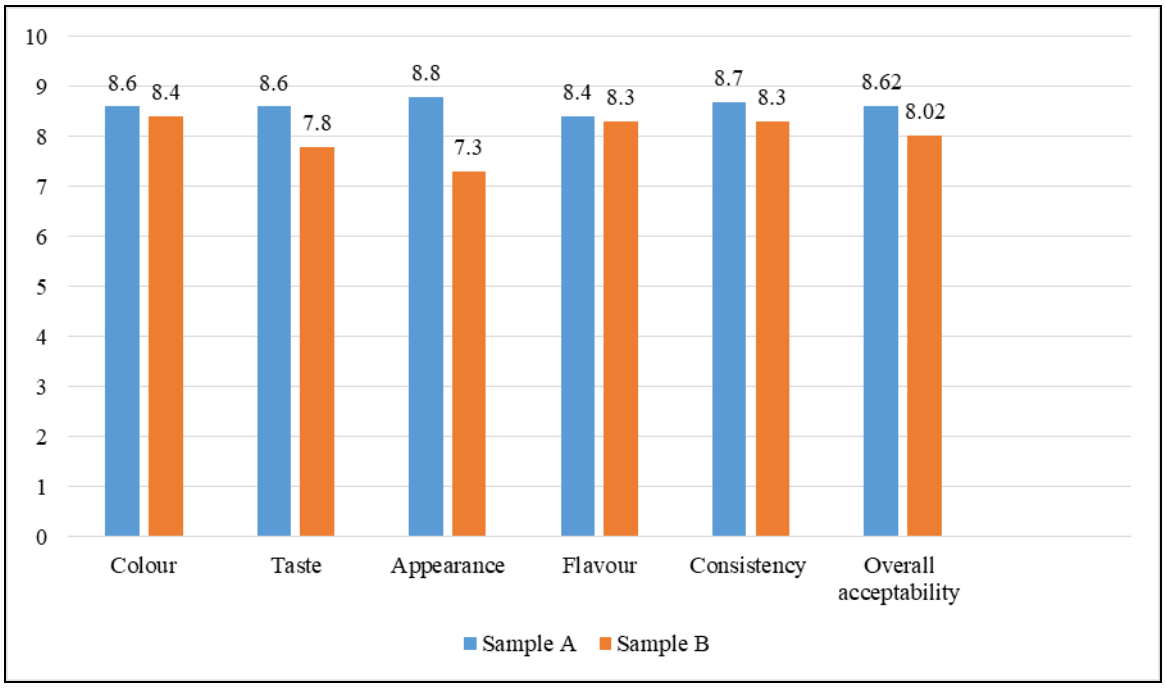

Fig 5: Graphical representation of sensory attributes of prepared jam variety

Nutritional composition of prepared jam variety

Nutritional composition of prepared jam variety were analysed by calculation of nutritive value by applying reference standard value (Longvah *et al*., 2017) [7]. Fig is good source of energy in the form of carbohydrates and mineral composition such as sodium, calcium, magnesium, phosphorus and iron. It has average protein and dietary fiber content with very little amount of fat (Polat *et al*., 2008). Nutritional composition varied for Sample-A and Sample -B. This may be due to ripening of fruit and ingredients used in the preparation of jam variety. It could be observed from Table 03, Sample- B yielded higher nutritional value for nutrients such as energy, carbohydrates, protein, fat, fibre, iron, calcium, thiamine, riboflavin, niacin, sodium, potassium and magnesium ;With the exception of Vitamin –A, Vitamin –C, pyridoxin and folic acid.

Table 3: Nutritional composition of prepared jam variety

Nutrients	Sample-A	Sample -B
Energy (Kcal)	463.64	840.64
Carbohydrates(g)	33.19	138.60
Protein(g)	4.60	8.60
Fat(g)	2.10	4.10
Fibre(g)	9.28	11.20
Iron(g)	4.50	9.40
Calcium(mg)	159.00	254.00
Vitamin-A(IU)	916.00	168.00
Thiamine(mg)	0.08	0.20
Riboflavin(mg)	0.04	0.20
Niacin(mg)	0.55	1.40
Vitamin-C(mg)	39.00	5.93
Pyridoxine(mg)	0.30	0.006
Folic acid(mg)	28.40	1.24
Sodium(mg)	4.60	68.12
Potassium(mg)	473.00	1291.00
Magnesium(mg)	53.00	152.89

Conclusion

Both fresh and dried figs can be used in jam making. They have low level of pectin content but nutritional significance play a vital role in health promotion. It is therefore recommended that detailed and improved food preservation research should be done on pectin content in figs to produce good quality jam with improved sensory attributes. This would improve post-harvest handling and availability of fruit based jam variety during off season of fruits.

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Declaration of Conflict of Interest

Authors declare that they have no conflict of interest.

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