Revolutionizing Snacks: Enhancing Nutrition with Germinated Wheat, Pearl Millet, and Mung Beans Flour in Biscuits and Soup Mix

Abstract

Cluster fig, also known as goolar in Hindi, is a medicinal fruit abundant in India, offering a rich source of iron and other essential micronutrients. Wheat, a staple in the Indian diet, is energy-dense and provides valuable carbohydrates and proteins. Pearl Millet, the most commonly grown type of millet, is renowned for its high calorie, vitamin, and mineral content. Mung beans, part of the legume family, are calorie-dense and a great source of protein and polyunsaturated fatty acids (Basavaraj *et al., (2010)*.

In this study, cluster fig powder, germinated wheat flour, germinated mung bean flour, germinated pearl millet, carrot powder, and beetroot powder were utilized for product development. Two products were developed with three treatments, varying the quantity of ingredients. Sensory and proximate analysis were conducted on the developed products, with each treatment having three different replications to minimize errors during analysis.

Organoleptic evaluation indicated that as the quantity of cluster fig increased, the taste became bitter, leading to decreased acceptability. Proximate analysis revealed that an increase in the quantity of cluster fig resulted in higher iron and zinc content in the products. This study highlights the organoleptic acceptability and nutritive & medicinal properties of cluster fig, providing insights into the appropriate quantities of cluster fig powder and other ingredients for various processed convenience healthy foods. The research emphasizes the use of cluster fig, a readily available fruit in India, which has not been previously utilized in convenience food products.

Keywords: Goolar; cluster fig; iron; organoleptic properties; mung beans.

Introduction:

Ficus racemosa, commonly known as Cluster Fig Tree or Gular, is a moderate-sized avenue plant native to Australia, Malaysia, South-East Asia, and the Indian Subcontinent. Belonging to the Moraceae family, it was previously classified under Urticaceae. The tree is widely distributed in India, especially in forests, hilly regions, and near water streams, and its fruits are a favored food of the common Indian macaque (Bhalerao *et al., 2009)*.

Cluster fig (Ficus racemosa) is renowned for its nutritional and medicinal prowess. Rich in antioxidants, vitamins, and minerals, it offers diverse health benefits. Fresh figs are low in calories yet high in dietary fiber, aiding in weight management and digestive health (USDA National Nutrient Database, 2000). Conversely, dried figs are more calorie-dense and provide essential nutrients like iron, potassium, and calcium, crucial for overall health (USDA National Nutrient Database, 2000). Traditionally, cluster fig has been utilized for its therapeutic properties. Its bark can alleviate mouth ulcers and oral infections, while a paste made from the inner bark can reduce pimples and freckles (Ghani, 2003). Dried figs with honey help control excessive bleeding in women with menorrhagia (Ghani, 2003). Additionally, cluster fig latex effectively treats burns, piles, and fistulas (Ghani, 2003).

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Cluster fig's medicinal benefits extend to treating dysentery, muscle pain, and stomach-aches. It also lowers blood sugar levels, benefiting individuals with diabetes (Ghani, 2003). Its efficacy in treating skin diseases, chickenpox, and urinary disorders further underscores its therapeutic potential (Ghani, 2003). In sum, cluster fig's nutritional and medicinal properties make it a valuable addition to the diet, promoting overall health and well-being.

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Fig. 1: Cluster fig fruit

Fig. 2: Cluster fig Powder

Research Methodology

The raw materials were sourced from local markets and the product was standardized. All experiments were conducted in the college laboratory. Two products, along with a control product for comparison, were developed and evaluated for organoleptic and proximate analysis. This study aimed to explore the potential of underutilized cluster fig in the development of convenient foods and to emphasize the nutritional composition of the products prepared with cluster fig. The control product includes all the ingredients except for cluster fig powder, which is added as a value-added component in the experimental products.

Preparation of samples

Table No. 1: **Preparation of Sample of Biscuit**

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Ingredients	T_1	T_2	T_3
Germinated wheat Flour	70 g	60 g	50 g
Germinated Pearl Millet Flour	15 g	20 g	25 g
Germinated Mung Beans Flour	10 g	10 g	10 g
Corn Starch Flour	3 g	5 g	7 g
Gular powder	3 g	5 g	7 g

Table No. 2: **Preparation of Sample of Soup Mix**

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Ingredients	T_1	T_2	T_3

Carrot Powder	40 g	50 g	60 g
Beetroot Powder	1 g	2 g	3 g
Germinated wheat Flour	15 g	10 g	7 g
Germinated Pearl Millet Flour	5 g	5 g	5 g
Germinated Mung Beans Flour	15 g	10 g	5 g
Rice Flour	10 g	10g	10 g
Corn Starch Flour	13 g	10 g	7 g
Gular powder	1 g	3 g	5 g

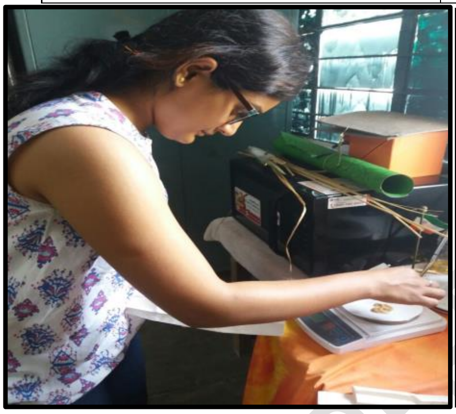

Fig 3: Weighing of sample for Ash estimation

Fig 4: Sample kept on weighing machine

Sensory and Nutritional evaluation of products

The sensory evaluation of the products was conducted using a hedonic scale, which is a standard scale for assessing liking and disliking. A panel of five members evaluated all the prepared products, including the control sample, and provided ratings based on their sensory attributes.

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The ash content, protein, and zinc content of the products were determined using the AOAC (2005) standard procedures. These methods were chosen for their adherence to the highest international standards for accuracy, reliability, and compliance. Protein content was calculated using the Kjeldahl method (AOAC 1582), while zinc content was determined using Atomic Absorption Spectroscopy (AAS). These methods are widely recognized for their universality, high precision, and reproducibility, making them the preferred choice for estimating protein and iron in foods. Statistical analysis, specifically ANOVA, was employed to establish the significance of the results obtained during the study period.

Results and Discussion

ORGANOLEPTIC EVALUATION:

Organoleptic evaluation of all the developed products was done in terms of all sensory characteristics like colour, appearance, flavour, texture, taste and overall acceptability on a 9-point hedonic scale.

- **BISCUIT:**

Biscuit is the most familiar product to all of us as ready to eat convenient food. Biscuits generally prepare from Maida. But in this study, Maida is not used for biscuit preparation. Only three different flours of germinated wheat, germinated pearl millet, germinated mung bean along with its value addition with cluster fig were used at different ratio.

Table No 3: Mean Score of all characteristics of sensory evaluation of biscuits

Characters	**Control**	**T_1**	**T_2**	**T_3**
Appearance	4.7	7.2	8.0	7.4
Taste	4.5	7.9	8.4	6.9
Flavour	4.0	7.3	7.7	6.0
Texture	4.0	7.3	8.0	6.9
Colour	4.4	7.3	7.8	7.6
Overall acceptability	4.7	7.6	8.2	6.9

In comparison with the control products T_2 got comparatively high scores than the control products. So it has been shown that T_2 is best according to all the characteristics of sensory evaluation than other three treatments. It has been observed a moderate ratio of cluster fig is responsible for imparting good taste and flavour to the biscuit because if the quantity of cluster fig powder increases the taste becomes bitter and if the quantity decreases the flavour also decreases (Bhoyar & Chappalwar (2014).

- ***Soup Mix***

Soup mix is one kind of convenient food which is ready to cook. Soup mix has been prepared with three different ratios of T_1, T_2 & T_3. Soup mix was prepared from all the three germinated flours along with its value addition with cluster fig. The result of organoleptic evaluation of soup mix is given below in Table No: 2.

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Table No. 4: Mean score of all the characteristics of sensory evaluation of Soup Mix.

Characters	**Control**	**T_1**	**T_2**	**T_3**
Appearance	7.2	7.6	5.9	5.4
Taste	6.9	7.2	5.8	4.4
Flavour	6.5	6.9	5.2	4.1
Texture	5.6	6.4	5.1	4.6
Colour	6.6	7.2	5.2	5.2
Overall acceptability	6.8	7.1	5.2	4.9

T_1 is best according to all the characteristics of sensory evaluation than other three treatments. It has been observed a moderate ratio of cluster fig is responsible for imparting good taste and flavour to the soup mix because if the quantity of cluster fig powder increases the taste becomes bitter and if the quantity decreases the flavour also decreases (Bnejdi & Gazzah (2010).

II. CHEMICAL COMPOSITION

Different treatments of products were analysed for their chemical composition together with control products. They were analysed for their proximate composition of ash, protein and zinc.

ASH

The evaluation of ash content was done with the help of muffle furnace. While evaluating the ash content of three different products 4 replications were taken for each control and treatments.

Table No. 5: Ash content in biscuits

Treatment	R_1	R_2	R_3	R_4	Mean
Control	9.36	12.67	10.20	11.92	11.03
T_1	7.90	8.50	12.60	11.76	10.19
T_2	8.74	13.00	9.90	10.58	10.55
T_3	9.01	10.2	13.70	10.68	10.89

SE(d)	1.36
CD	2.90

All three replications have different level of ash content. In mean result the control product contain greater amount of ash i.e., 11.03% compare to other treatment. The different level of ash content in each replication obtained is due to experimental error. This error arises due to some atmospheric measurement like atmospheric temperature, pressure, relative humidity. The ash content of control sample was found to be higher than other treatments i.e. 11.03%, whereas different treatment of T_1 , T_2 & T_3 revealed ash content of 10.19%, 10.55% & 10.89% mean value respectively. It can be said that increase in the quantity of cluster fig powder and decrease in the quantity of germinated wheat flour increases the ash content in the product (Clifford *et al.,* (2015).

Table No. 6: Ash content in Soup Mix

Treatment	R_1	R_2	R_3	R_4	Mean
Control	5.6	16.00	20	12.86	13.61
T_1	13.20	18.00	25.30	17.83	18.58
T_2	13.23	9.42	10.99	12.98	11.65
T_3	4.36	19.80	4.70	12.78	10.41

SE(d)	2.96

CD	6.44

Table 6 has shown that all three replications have different level of ash content. In mean result the control product has amount of ash i.e., 13.61% compare to other treatment. The different level of ash content in each replication obtained is due to experimental error. This error arises due to some atmospheric measurement like atmospheric temperature, pressure, relative humidity.

The comparable results of soup mix has shown that in the table 4, the ash content of control sample was found to be 11.03%, whereas different treatment of T_1 , T_2 & T_3 revealed ash content of 18.58%, 11.65% & 10.41% mean value respectively. It can be said that increase in the quantity of cluster fig powder and decrease in the quantity of germinated wheat flour increases the ash content in the product (Feliciano & Waniska (2015).

PROTEIN

The evaluation of protein content was done with the help of kel plus. While evaluating the protein content of three different products 4 replications were taken for each control and treatments.

Table No. 7: Protein Content in Biscuit

Treatment	**R_1**	**R_2**	**R_3**	**R_4**	**Mean**
Control	3.46	3.31	3.77	3.64	3.54
T_1	3.92	3.89	3.97	3.96	3.93
T_2	4.21	4.14	4.19	4.11	4.16
T_3	5.72	5.70	5.69	5.67	5.69

SE(d)	0.05
CD	0.108

Table 7 has shown that all three replications have different level of protein content. In mean result the control product has amount of protein i.e., 3.54 compare to other treatment. The different level of protein content in each replication obtained is due to experimental error. This error arises due to some atmospheric measurement like atmospheric temperature, pressure, relative humidity (Adam *et al.,*(2009).

The comparable results of biscuit has shown that in the table 5, the protein content of control sample was found to be 3.54, whereas different treatment of T_1 , T_2 & T_3 revealed protein content of mean value 3.93, 4.16 & 5.69 respectively. It can be said that increase in the quantity of cluster fig powder increases the protein content in the product (Godfrey *et al.,*(2010).

Table No. 8: Protein Content in Soup Mix

Treatment	**R_1**	**R_2**	**R_3**	**R_4**	**Mean**

Control	4.24	4.18	4.23	4.15	4.20
T_1	5.77	5.75	5.74	5.72	5.74
T_2	6.80	6.83	6.87	6.79	6.82
T_3	6.98	7.01	7.13	6.93	7.01

SE(d)	0.67
CD	1.46

Table 8 has shown that all three replications have different level of protein content. In mean result the control product has amount of protein i.e., 4.20 compare to other treatment. The different level of protein content in each replication obtained is due to experimental error. This error arises due to some atmospheric measurement like atmospheric temperature, pressure, relative humidity.

The comparable results of soup mix has shown that in the table 8, the protein content of control sample was found to be 4.20, whereas different treatment of T_1, T_2 & T_3 revealed protein content of mean value 5.74, 6.82 & 7.01 respectively. It can be said that increase in the quantity of cluster fig powder increases the protein content in the product.

ZINC

The evaluation of zinc content was done with the help of AAS. While evaluating the zinc content of three different products 4 replications were taken for each control and treatments.

Table No. 9: Zinc Content in Biscuit

Treatment	**R_1**	**R_2**	**R_3**	**R_4**	**Mean**
Control	223.80	224.90	221.60	220.90	222.80
T_1	117.40	116.60	119.80	118.90	118.17
T_2	220.20	221.40	218.40	216.40	219.10
T_3	232.60	231.40	230.60	228.40	231.75

SE(d)	1.30
CD	2.83

Table 9 has shown that all three replications have different level of zinc content. In mean result the control product has amount of zinc i.e., 222.80% compare to other treatment. The different level of zinc content in each replication obtained is due to experimental error. This error arises due to some atmospheric measurement like atmospheric temperature, pressure, relative humidity.

The comparable results of biscuit has shown that in the table 9, the zinc content of control sample was found to be 222.80%, whereas different treatment of T_1, T_2 & T_3 revealed zinc content of 118.17%, 219.10% & 231.75% mean value respectively. It can be said that increase in the quantity of cluster fig powder and increases the zinc content in the product (Pradeep and Manisha (2011).

Table No. 10: Zinc Content in Soup Mix

Treatment	R_1	R_2	R_3	R_4	Mean
Control	195.60	190.40	192.30	194.40	193.17
T_1	110.80	109.40	114.20	113.90	112.07
T_2	113.80	114.40	112.90	117.00	114.52
T_3	119.60	112.60	116.80	117.00	116.50

SE(d)	1.67
CD	3.64

Table 10 has shown that all three replications have different level of zinc content. In mean result the control product has amount of zinc i.e., 193.17% compare to other treatment. The different level of zinc content in each replication obtained is due to experimental error. This error arises due to some atmospheric measurement like atmospheric temperature, pressure, relative humidity (Kumar *et al.,* (2011).

The comparable results of soup mix has shown that in the table 10, the zinc content of control sample was found to be 193.17%, whereas different treatment of T_1 , T_2 & T_3 revealed zinc content of 112.07%, 114.52% & 116.50% mean value respectively. It can be said that increase in the quantity of cluster fig powder and increase in the quantity of carrot powder & beetroot powder increases the zinc content in the product.

Conclusion

Organoleptic Evaluation:

The organoleptic evaluation of the value-added products, including biscuits, kachari, and soup mix, was conducted using a 9-point hedonic scale. For biscuits, the treatment T2 (cluster fig powder: germinated wheat flour: germinated pearl millet flour: germinated mung flour; 5:60:20:10) received the highest scores for appearance, taste, flavor, texture, color, and overall acceptability compared to other treatments and the control. For soup mix, treatment T1 was rated the highest in overall acceptability. Overall, it was observed that a moderate ratio of cluster fig powder contributed to better taste and flavor in the products.

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Chemical Composition:

The ash content was higher in the control samples compared to treatments, indicating that the addition of cluster fig powder reduced the ash content. Protein content also increased with the addition of cluster fig powder, indicating its potential as a protein source. Zinc content showed a similar trend, increasing with the addition of cluster fig powder.

Overall, the results suggest that the addition of cluster fig powder has a positive impact on the organoleptic and chemical properties of the products, making them potentially valuable as nutritious and tasty food options.

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