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Nutritional Values of Biscuits and Kachari with Varying Concentrations of Germinated Wheat Flour, Pearl Millet Flour and Mung Beans Flour

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Cluster fig, goolar in hindi, is a medicinal fruit, widely found in India. It is a rich source of iron and other micronutrients. Wheat is a staple food of Indian diet which is an energy dense food. It is a good source of carbohydrate & protein. Pearl Millet is most widely grown type of millet. It is known for its calorie value; vitamins & minerals present in it. Mung bean which belongs to the family of legumes has high calorie in it & is also a very good source of protein & poly-unsaturated fatty acid. For this study cluster fig powder, germinated wheat flour, germinated mung bean flour, germinated pearl millet, carrot powder & beetroot powder have been used. The product development was done using the above-mentioned ingredients. Two products with three treatments of varying quantity of ingredients was used for product development. The developed products undergone sensory and proximate analysis. Each treatment has three different replications to minimise the error during

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proximate analysis. Each product has three treatments for sensory evaluation and nutritional assessment with three different replications.
The organoleptic evaluation highlight that the taste becomes bitter and the acceptability decrease with Increased quantity of cluster fig. The proximate analysis concludes that with increase in the quantity of cluster fig, the iron and zinc content of the products increase. This study shed light on evaluation of organoleptic acceptability and nutritive & medicinal properties of cluster fig. It also provides idea on how much quantity of cluster fig powder & other ingredients should be used in various processed convenience healthy food. The research aims at highlighting the use of cluster fig which is widely available in India but has never been used to make convenience.

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

1. INTRODUCTION

Food is the basic and common need of everyone. Between the extremes of optimal health and death from starvation or malnutrition, there is an array of diseases states that can be caused or alleviated by changes in diet. Deficiencies, excesses, and imbalance in diet can produce negative impacts on health, which may lead to various health problems such as scurvy, obesity or osteoporosis, diabetes, cardiovascular diseases as well as psychological and behavioral problems [1-4]. The science of nutrition attempts to understand how and why specific dietary aspects influence health. Ficus racemosa (Linn) is a moderate size avenue plant, belongs to family- Moraceae (Earlier this plant was placed in family Urticaceae but according to the modern views it should be placed in a separate family Moraceae which is separated from family Urticaceae) which is usually known as Cluster fig Tree, Indian fig Tree or Gular. It is an evergreen, moderate to large sized spreading, lactiferous, decidious tree, without much prominent aerial roots [5-9]. Fig fruit is low in calories. 100 g fresh fruits carry only 74 calories. However, they contain health benefiting soluble dietary fiber, minerals, vitamins, and pigments antioxidants that contribute immensely towards optimum health and wellness. Additionally, fresh figs contain adequate levels of some of the anti-oxidant vitamins such as vitamin-A, E, and K. Altogether these phytochemical compounds in fig fruit help scavenge harmful oxygen-derived free radicals from the human body and thereby protect us from cancers, diabetes, degenerative diseases, and infections [10,11]. Furthermore, research studies suggest that chlorogenic acid in the figs help lower blood sugar levels and control blood glucose levels in type-II diabetes mellitus (adult-onset) condition. Cluster fig is a power house of health benefits and is known for its medicinal properties [12-14]. The phytochemicals present in the plant constitutes as the bioactive substance that is the catalyst in prevention of diseases and also aids in curing them. Because of these reasons it has been used as a part of the study to explore the nutritional value of this plant in combating various nutritional problems.

Fig. 1. Cluster fig fruit

2. METHODOLOGY

The raw materials were procured from the local market. Standardisation of the product was done. The college laboratory was used to conduct all the experiments. Two products along with control product for comparison was made during the period of study and was evaluated for organoleptic and proximate analysis. The study was conducted to utilise the underexplored cluster fig for the preparation of convenience food and also highlight on the nutritional composition of prepared products using cluster fig.

2.1 Control Product

The control product has all the other ingredients except gular powder which as value added product.

Table 1. Preparation of sample of biscuit

Ingredients	T_1	T_2	T_3	Number of Replication
Germinated wheat Flour	70 g	60 g	50 g	*3 replications*
Germinated Pearl Millet Flour	15 g	20 g	25 g	*were made for*
Germinated Mung Beans Flour	10 g	10 g	10 g	*each treatment*
Corn Starch Flour	3 g	5 g	7 g	T_1R_1; T_1R_2; T_1R_3
Gular powder	3 g	5 g	7 g	T_2R_1; T_2R_2; T_2R_3
				T_3R_1; T_3R_2; T_3R_3

T_1 – Treatment 1; T_2 – Treatment 2; T_3 – Treatment 3
T_1R_1 - Treatment 1 replication 1; T_1R_2 -Treatment 1 replication 2; T_1R_3-Treatment 1 replication 3
T_2R_1 - Treatment 2 replication 1; T_2R_2-Treatment 2 replication 2; T_2R_3-Treatment 2 replication 3
T_3R_1 - Treatment 3 replication 1; T_3R_2-Treatment 3 replication 2; T_3R_3-Treatment 3 replication 3

Table 2. Preparation of sample of extruded product kachari

Ingredients	T_1	T_2	T_3	Number of Replications
Germinated wheat Flour	15 g	15 g	15 g	*3 replications were*
Germinated Pearl Millet Flour	20 g	20 g	20 g	*made for each*
Germinated Mung Beans Flour	25 g	20 g	15 g	*treatment*
Rice Flour	25 g	25g	25 g	T_1R_1; T_1R_2; T_1R_3
Corn Starch Flour	10 g	10 g	10 g	T_2R_1; T_2R_2; T_2R_3
Gular powder	5 g	10 g	15 g	T_3R_1; T_3R_2; T_3R_3

T_1 – Treatment 1; T_2 – Treatment 2; T_3 – Treatment 3
T_1R_1 - Treatment 1 replication 1; T_1R_2 -Treatment 1 replication 2; T_1R_3-Treatment 1 replication 3
T_2R_1 - Treatment 2 replication 1; T_2R_2-Treatment 2 replication 2; T_2R_3-Treatment 2 replication 3
T_3R_1 - Treatment 3 replication 1; T_3R_2-Treatment 3 replication 2; T_3R_3-Treatment 3 replication 3

2.2 Pictures of Proximate Analysis

Fig. 2. Weighted Samples to be kept in oven for Moisture Estimation

Fig. 3. Samples kept in dishes

2.3 Sensory Evaluation of the products

The hedonic scale is a standard scale used to assess the liking and disliking regarding the prepared products along with the control sample. A panel of 5 members have evaluated all the prepared products and give their ratings accordingly.

2.4 Nutritional Evaluation of Products

The Moisture content, protein and iron content were calculated using standard procedure of AOAC (2005). The AOAC method was used because they meet the highest international standards for accuracy, reliability, and compliance. The protein was calculated using

kjeldal method and iron was calculated using AAS. Its universality, high precision and good reproducibility have made it the major method for the estimation of protein and iron in foods. ANOVA test was used to statically establish the results obtained during the study period.

3. RESULTS AND DISCUSSION

3.1 Organoleptic Evaluation

A variety of products including biscuit and kachari were developed from cluster fig powder, germinated wheat flour, germinated pearl millet flour and germinated mung flour with different ratios of Cluster fig, germinated wheat flour, germinated pearl millet flour and germinated mung beans.

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. A mean liking score of 7 or higher on a nine-point scale is usually indicative of highly acceptable sensory quality which is why 9-point hedonic scale was made into use for sensory analysis.

On the basis of overall acceptability, the score revealed that T2 (7.1) is rated as “like very much” In comparison with the control products T2 got comparatively high scores (7.1) than the control product (5.8). It depicts T2 as best on all the characteristics of sensory evaluation than other two treatments. In kachari, when compared with the control product, T1 got comparatively high scores (7.4) than the control product (6.2). This illustrate that T1 was highly acceptable according to all the characteristics of sensory evaluation than other treatments. It can be concluded that a moderate ratio of cluster fig was responsible for imparting good taste and flavour. If the quantity of cluster fig powder increases the taste becomes bitter and if the quantity decreases the product loose its distinct flavour. A study conducted by Sevilla et al. [15] also showed similar results.

3.2 Proximate Analysis

In mean result the control product contain less amount of moisture (19.45%). The comparable results of biscuits have shown that in the Table 4, the moisture of control sample was found to be lower than other treatments (19.45%), whereas different treatment of T1, T2 & T3 revealed moisture 22.13%, 22.71% & 30.07% 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 moisture content in the product.

Table 3. Mean score of all characteristics of sensory evaluation of products

	Overall acceptability of Biscuits	Overall acceptability of Kachari
S.E.(d)	0.35	0.529
C.D.at 5%	0.74	1.103

Table 4. Moisture content of biscuits

Treatment	R_1	R_2	R_3	Mean
Control	24.60	20.70	19.80	19.45
T_1	19.78	21.98	22.17	22.13
T_2	13.70	25.80	29.60	22.71
T_3	31.20	29.60	21.76	30.07
SE(d)				3.27
CD				7.12

Table 5. Moisture content in extruded product kachari

Treatment	R_1	R_2	R_3	Mean
Control	13.70	11.80	19.20	16.80
T1	17.80	21.80	19.00	20.37
T2	31.70	23.90	27.40	28.02
T3	24.80	32.60	27.90	28.60
SE(d)				2.31
CD				5.05

Table 5 shows that all three replications have different level of moisture content. In mean result the control product contain less amount of moisture (16.80%). The comparable results of kachari shows that the moisture of control sample was found to be lower than other treatments (16.80%), whereas different treatment of T_1, T_2 & T_3 revealed moisture 20.37%, 28.02% & 28.60% 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 moisture content in the product.

3.3 Iron

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

Table 6 shows that all three replications have different level of iron content. In mean result the control product has amount of iron (316.07ppm) compared to other treatment.

The comparable results of biscuit have shown that in the Table 6, the iron content of control sample was found to be 316.07ppm, whereas different treatment of T_1, T_2 & T_3 revealed iron content of 328.92ppm, 343.32ppm & 461.25ppm mean value respectively. It can be said that increase in the quantity of cluster fig powder increases the iron content in the product. The study was supported by another study conducted by Clifford et al. [16] where the iron content of the product increases with increase in the quantity of ingredients.

Table 7 has shown that all three replications have different level of iron content. In mean result the control product has amount of iron (199.05ppm) compared to other treatment. The different level of iron 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 kachari has shown that in the Table 7, the iron content of control sample was found to be 199.05mg, whereas different treatment of T_1, T_2 & T_3 revealed iron content of 227.30ppm, 242.15ppm & 302.57ppm mean value respectively. It can be said that increase in the quantity of cluster fig powder increases the iron content in the product.

3.4 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 8 has shown that all three replications have different level of protein content. In mean result the control product has amount of protein (3.54 g) compared to other treatment.

Table 6. Iron content in biscuit

Treatment	R_1	R_2	R_3	Mean
Control	315.00	316.60	314.90	316.07
T_1	329.60	327.90	328.00	328.92
T_2	344.40	348.40	339.80	343.32
T_3	461.60	460.90	462.70	461.25
SE(d)				1.58
CD				3.44

Table 7. Iron Content in kachari

Treatment	R_1	R_2	R_3	Mean
Control	197.60	200.60	198.40	199.05
T_1	227.20	229.80	226.40	227.30
T_2	241.80	242.70	240.30	242.15
T_3	300.40	304.20	301.90	302.57
SE(d)				1.13
CD				2.46

Table 8. 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 9. Protein content in kachari

Treatment	R_1	R_2	R_3	Mean
Control	2.98	2.93	2.89	2.94
T_1	4.82	4.79	4.88	4.82
T_2	5.03	5.09	5.14	5.11
T_3	5.98	5.96	6.03	6.01
SE(d)				0.223
CD				0.48

The comparable results of biscuit have shown that in the Table 8, the protein content of control sample was found to be 3.54 g, whereas different treatment of T_1, T_2 & T_3 revealed protein content of mean value 3.93 g, 4.16 g & 5.69 g respectively. It can be said that increase in the quantity of cluster fig powder increases the protein content in the product. The results coincide with the study conducted by Wruss et al. [17].

Table 9 shows that all three replications have different level of protein content. In mean result the control product has amount of protein (2.94 g) compared to other treatment.

The comparable results of kachari have shown that in the Table 9, the protein content of control sample was found to be 2.94g whereas different treatment of T_1, T_2 & T_3 revealed protein content of 4.82g, 5.11g & 6.01g mean value respectively. It can be said that increase in the quantity of cluster fig powder increases the protein content in the product. The results coincide with the study conducted by Yadav et al., (2018) where it was also observed that with increase in the quantity if cluster fig powder the nutrient contents increase.

4. CONCLUSION

In both the product there is varied difference of moisture in the product. The difference may be due external factor or it may be due to the difference in method of preparation of the product. One other factor that also contributes to the difference in the moisture content is the change in the ratio of ingredients among each treatment.

Iron content in biscuit control sample, T_1, T_2 and T_3 were found to be 316.07 ppm, 328.92 ppm, 343.32 ppm and 461.25 ppm respectively. In the product kachari, the control product got 199.05 ppm iron content and the treatments have iron content of T1 has 227.30 ppm, T_2 has 242.15 ppm & T_3 has 302.57 ppm. One other factor that also contributes to the difference in the content is the change in the ratio of ingredients among each treatment. It has been found that iron content increases with increase in the quantity of cluster fig powder because cluster fig has good iron content when compared with its other two treatments.

Protein content in biscuit control sample, T_1, T_2 and T_3 were found to be 3.54, 3.93, 4.16 & 5.69. In the product kachari, the control product got 2.94 protein content and the treatments have protein content of T_1 has 4.82, 5.11 & 6.01. It has been found that protein content increases with increase in the quantity of cluster fig powder & mung bean because both have fairly good protein content in it.

From the above research it has been concluded found that cluster fig which is not yet incorporated in the diet has very good nutritional value. It has therapeutic as well as medicinal properties in it. When we try to incorporate this valuable ingredient in diet, we have found that it increases its medicinal properties and the taste of the product. It is also good in both ways sweet and salty. The

nutritional parameter on which the product has been tested is moisture, iron and protein The product has good iron & protein content in it. It was concluded that he product is good for ladies in the age group of 18 to 40 years because in this age women mostly give birth to young ones and also major menstrual problems occur in this age. It has been found that the normal iron requirement of women in this age according to RDA is 18 mg, protein requirement is 55g/day Through the products made during the research with the incorporation of cluster fig powder, pearl millet and mung bean powder it has been found that we are able to provide of good iron and protein content through biscuits and kachari.

CONFERENCE DISCLAIMER

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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