

Standardization and evaluation of gluten free biscuits

Subasshini V¹, Geetha S², Vinitha M³

^{1,2&3} Assistant Professor, Department of Home Science- M.Sc. Food Science, Nutrition and Dietetics,
S.D.N.B Vaishnav college for women, Chromepet, Chennai-44 (Tamil Nadu) India

subalasairam14@gmail.com

ABSTRACT

Celiac disease is a gluten sensitivity which affects the immune system when the intestine gets exposed to gluten responds thereby damaging or destroying the intestinal villi leading to malabsorption of nutrients. The gluten free diet is the only the remedy for treating celiac disease since the gluten free food items which has not been easily available in the market, the study was aimed to formulate and analyse gluten free biscuits with bamboo rice flour. Gluten free biscuits were obtained by varying the proportions of flours like bamboo rice flour, green gram dal flour, butter, powdered sugar and milk. The sensory attributes of the gluten free biscuits were analysed for consumer acceptability using a 9 point Hedonic scale. The best accepted proportion was determined for proximate composition under triplicate. The mean score and standard deviation of energy, protein, fat, carbohydrate and fibre were 197.5 ± 0.5 , 32.2 ± 0.2 , 6.3 ± 0.15 , 2.27 ± 0.01 and 4.3 ± 0.2 respectively. The developed biscuits were rich in protein, fibre, nutrient dense and can be recommended for celiac disease also for the other individuals.

Key words: Gluten free, Bamboo rice, celiac disease, proximate composition.

INTRODUCTION

In the early days the people were stick to the most of the simple foods like rice, pulses, corn, bajara, ragi etc. and there was no awareness of cooking new food items but the years ago the man has started of cooking new food items to change the taste of the food with the same homemade ingredients which has been already used in the traditional foods. According to Garg *et al.*, 2015 the food which is nothing about filling the hungry stomach but it is driving the people with the taste it leaves behind. It has become popular in different cross section of population due to high demand for the convenient food items to the populations.

Biscuit is the most important item in bakery industry. Biscuit is a chemically bread type of product. The term biscuit was derived from the Latin word bis and coctus which means twice cooking. At first the biscuits are normally baked

and the dried out to remove the moisture content. The removal of moisture content in the biscuits helps to improve the shelf life period (*Fleming. 1981*).

Indians are the hard die of rice lovers and nobody can take privilege from us. Rice is the stable food in tamilnadu with largest production (*Sita D.K, Ponnarasi T, 2009*). Actually there are many varieties of rice that may not be as so popular, but make our history of rice richer. The bamboo rice which is also known as Mulayari rice (<https:// Food ndtv.com>)

Bamboo rice is rich in most of the nutrients such as carbohydrates, fiber and protein. Bamboo rice has a low glycemic index (20) when we compared to other varieties of rice hence it is considered to be the healthier option for the diabetic patient, it lowers the cholesterol level and it is recommended for the pregnant women to overcome the vitamin deficiency, since it is rich in fibre content, thus preventing from constipation. (*Selvarajan et al., 2016*).

Green gram (*vigna radiate*) belong to the family leguminosae which is commonly called as a mung bean. It is considered to be the important pulse crops in India which contains about 25 percent of protein which is almost three times better than that of cereals. (*Bakane et al., 2018*). It is a good source of carbohydrates, proteins and minerals. The protein quality of the green gram is similar to the other legumes such as chickpea, black gram, peas and pigeon pea.

Now-a- days there are lot of people suffering from gluten related disorders such as celiac disease, wheat allergy, gluten ataxia and dermatitis. Celiac disease which is also called as gluten sensitive enteropathy. It is a chronic disorder of the small intestine which is caused by exposure to gluten in the genetically predisposed individuals (*Hamer 2005*). Gluten free diet have so much of benefits such as recovery of the villi of the small intestine and reduction of malignant complications. The exclusion of gluten from the diet is a genetically susceptible people which can lead to a small intestine damage so due to increase in awareness and diagnostic methods among the people the demand for the gluten free products which has been increased (*Tanwar 2016*).

Gluten free rice biscuits were prepared from a combination of bamboo rice and green gram dhal in 4:2 ratio. Since bamboo rice is a gluten free, it can be an ideal biscuit for the people who are having celiac disorder. The gluten free foods which has not be easily available in the market. Based on these effects, the current study aims to develop gluten free biscuits with bamboo rice flour.

Hence the study is entitled with “Standardization and evaluation of gluten free biscuits” was undertaken with the following objectives:

- To formulate gluten free biscuits.
- To examine sensory analysis.
- To analyse its nutrient profile, microbial evaluation and shelf life.

MATERIALS AND METHODS

Experimental Materials

Bamboo rice was procured from the organic shop, Chennai, India. Green gram dal, butter, sugar, milk, baking powder, salt was procured from the local supermarket, Chennai, India.

Raw Materials

- Bamboo rice
- Green gram dhal
- Sugar
- Butter
- Milk

PRE-PREPARATION

The procured raw materials were pre-pared before the preparation of the biscuit

Processing of bamboo rice flour: Bamboo rice was cleaned then it was firmly roasted in a pan and then it was ground to make as a flour then the flour was packed, sealed and stored.

Processing of green gram flour: Green gram dal was roasted in a pan and made into a fine powder using the mixer. Then the flour was packed, sealed and stored.

Processing of powdered sugar: The procured sugar was finely powdered using the mixer and the powdered sugar was packed, sealed and stored.

METHOD OF PREPARATION

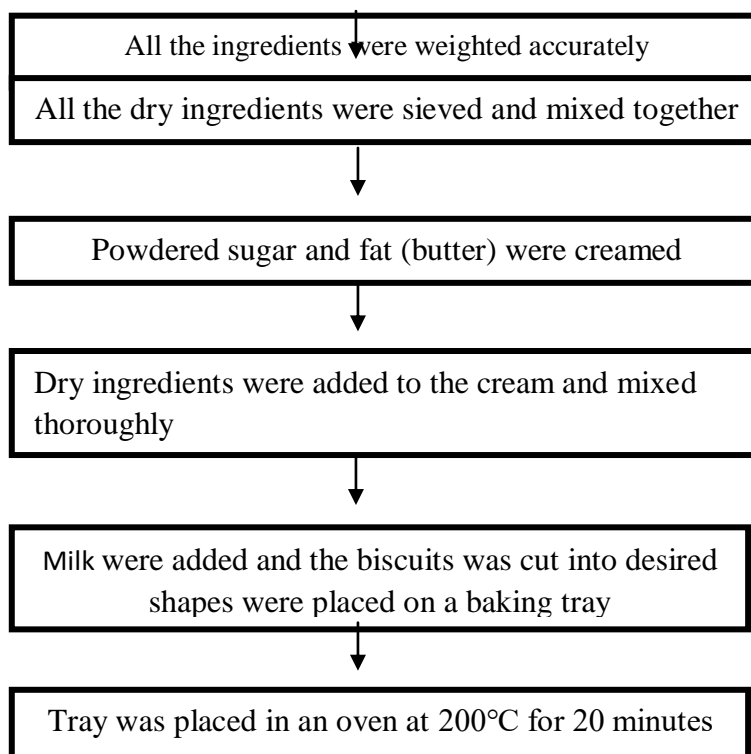


FIGURE-1 FLOW CHART FOR THE PREPARATION OF GLUTEN FREE BISCUITS

The biscuits were prepared according to the standardized recipe (*Thangam E.philip The modern cookery*) with the slight modifications. The bamboo rice flour, green gram dhal flour, powdered sugar and butter will be taken in these ratio 50:35:10:5, 50:30:10:10, 50:20:20:10 respectively. All the ingredients were weighted separately. At first, the powdered sugar and fat (butter) were creamed with the electric mixer. Next, the baking powdered were added followed by the bamboo rice flour and the green gram dal flour. Then the soft dough was developed and the little amount of milk was added to make the soft dough. The dough was cut into desired shape and size and it was placed on the greased tray and kept in the oven at 200°C for 20 minutes (*Mounika 2016*)

ORGANOLEPTIC EVALUATION

The product were made and determined to see the characteristic of colour, flavour, texture, appearance, taste and overall acceptability of the gluten free biscuits and evaluation has done in the nine point hedonic scale. Evaluation is

the most important procedure when developed the new food product. It was carried out by five trial. Each trial was evaluated by the panel of 25 members of P.G student. Each panel members was provided with the nine point hedonic score card and require full coordination to fill the score card.

PROXIMATE ANALYSIS

The gluten free biscuits sample was formulated and standardized for energy, protein, fat, carbohydrates, fiber, ash and moisture were determined by AOAC 2000 method.

RESULTS AND DISCUSSION

Sensory Evaluation

TABLE:1 SENSORY EVALUATION OF GLUTEN FREE BISCUITS

Treatments	Colour	Flavour	Texture	Appearance	Taste	Overall Acceptability
T1	7.90±0.7	7.90±0.7	7.7±0.7	8.1±0.8	7.3±0.4	7.8±0.4
T2	7.95±0.6	7.91±0.7	8.0±0.7	8.0±0.7	7.5±0.5	7.8±0.4
T3	8.8±0.4	8.4±0.6	8.6±0.4	8.9±0.2	8.9±0.2	8.7±0.2

The gluten free biscuits were prepared by bamboo rice and it was subjected to sensory evaluation. The mean score for the gluten free biscuits are presented in the table1. The results showed that the colour for the different were 7.90, 7.95 and 8.8 respectively. The treatment T3 (8.8) was found to be the high acceptable by the panel members. There was a significant difference in the colour with p- value < 0.05.

The mean score for flavour of the different treatments were 7.90, 7.91 and 8.4 respectively. From the above result it was cleared that the treatment T3 (8.4) has the highest value for flavour. There was a significant difference in the flavour with p-value < 0.05

The texture of the gluten free biscuits were 7.7, 8.0 and 8.6. From the above results it showed that the treatment T3 (8.6) has the highest value for texture than the other treatments. There was a significant difference in the texture with p-value < 0.05

The appearance of the gluten free biscuits were 8.1, 8.0 and 8.9. From the above results it understood that the treatment T3 (8.9) has got the highest score for the appearance than the other treatments. There was a significant difference in the appearance with $p\text{-value} < 0.05$.

As evident from the table 1, the treatment T3 tastes better than the other treatments. T3 has the highest mean score and standard deviation of (8.9 ± 0.2) followed by T2 (7.5 ± 0.5) and T1 (7.3 ± 0.4) . There was a significant difference in the p value of < 0.05 . According to *kumar, 2016* the gluten free quinoa based cookies which were prepared using rice and quinoa flour T1, T2, T3 at 5, 10, 15 gram respectively. The results showed for the scores of sensory parameters T2 treatment were found to be higher 7.46 than the T1 (7.4) & T3 (7.2). The T2 treatment was more acceptable than the other test samples. By comparing with the above results the overall acceptability of the gluten free rice biscuits has the highest score.

Microbial quality of the gluten free rice biscuits

The T3 product of the gluten free rice biscuits were stored in ambient condition and microbial load was assessed.

Total bacterial count

TABLE: 2 TOTAL BACTERIAL COUNT OF THE BISCUITS DURING STORAGE

Storage period	Total bacterial count (CFU/UNIT)
0 th day	45
15 th day	175
30 th day	200

The *total bacterial count* for the developed gluten free biscuits at the beginning (0th day) of the storage was 0.45×10^2 cfu/ml and it was gradually increase at the (15th day) such as 1.75×10^2 cfu/ml and at the end of the storage study period (30th day) it was 2.00×10^2 cfu/ml.

According to *Nagi et al., 2012* the *total bacterial count* for the developed rice bran biscuits at the beginning (0th day) of the storage study was 0.90×10^2 cfu/ml and it was gradually increase at the (15th day) such as 2.50×10^2 cfu/ml and at the end of the storage study period (60th day) it was 2.50×10^2 cfu/ml. Likewise *Mounika, 2016* revealed that the total bacterial count for the germinated brown rice cookies was observed on the 0th day (Nil), 15th day (1.0×10^3 cfu)

and 30th day (2.0×10^3 cfu). By comparing with above study it was found that there was a lower value of *total bacterial count* obtained in current study so it has a longer shelf life and safe to consume.

Yeast and mould count

TABLE: 3 YEAST AND MOULD COUNT OF THE BISCUITS DURING STORAGE

Storage period	Yeast and mould count(CFU/UNIT)
0 th day	Nil
15 th day	25
30 th day	39

The *yeast and mould* count for the developed gluten free biscuits at the beginning (0th day) of the storage study was nil and it was gradually increase at the (15th day) such as 2.5×10^2 cfu/ml and at the end of the storage study period (30th day) it was 3.9×10^2 cfu/ml.

According to *Agu and Okoli, 2014* the yeast and mould count for the developed wheat based biscuits incorporated with beniseed and unripe plantain at the beginning (0th day) of the storage study was nil and it was gradually increase at the (15th day) such as 2.0×10^4 cfu/ml and at the end of the storage study period (30th day) it was 3.0×10^4 cfu/ml. Similarly *Mounika, 2016* stated that the yeast and mould count for the germinated brown rice cookies was observed on the 0th day (Nil), 15th day (Nil) and 30th (1.0×10^3 cfu). By comparing with above study it was found that there was a lower value of yeast and mould count obtained in current study therefore its consider to be a longer shelf life.

Shelf life study

The product were evaluated for shelf life by sensory evaluation and microbial quality on 0th day at a regular interval of 15 days over a period of one month by semi trained panellists using a 9.0 point hedonic scale for overall acceptability.

All the treatments T1, T2 and T3 were prepared in an aseptic manner and T3 the best outcome was used for evaluating shelf life of gluten free biscuits. The treatment T3 was observed for shelf life on 0th day, 15th day and 30th day respectively. On 0th day all the aspects like taste, colour, flavour, texture and appearance were checked and biscuits were in good state showing desirable characters and overall acceptability was (8.7). On 15th day, evaluations of biscuits were done using the same criteria as like 0th day. It was noted that there was a slight difference seen in the texture, since there is a mild put down in the crispiness of biscuits. On 30th day observation of shelf life showed mild changes in texture and flavour of the biscuits. A mild rancid flavour was experienced while; biscuits were still in good palatable and consumable condition. The results of the sensory scores of the gluten free biscuits from initial day to end of storage period were presented in the table 4.

TABLE: 4 SENSORY SCORES AFTER THE STORAGE OF BISCUITS

Storage period	Taste	Colour	Flavour	Texture	Appearance	Overall Acceptability
0 th day	8.9±0.2	8.8±0.4	8.4±0.6	8.6±0.4	8.9±0.2	8.7±0.2
15 th day	7.5±0.50	7.8±0.5	7.1±0.4	7.6±0.4	7.4±0.5	7.4±0.2
30 th day	6.7±0.4	6.5±0.5	6.6±0.5	6.6±0.4	6.6±0.4	6.7±0.2

The result obtained from the study *Mounika,2016* pointed that 10% Germinated brown rice incorporated cookies rated with the highest acceptability among those three variations (10%, 20% and 30%). On the first day, the samples showed the highest scores for all parameters evaluated i.e. colour, texture, taste, flavour and overall acceptability (7.40). The profile changed considerably after a 15 days of storage period the overall acceptability was (7). There was a significant decrease ($p<0.05$) in the sensory characteristics of cookies after 30th day of storage and overall acceptability (6.5). similarly *Chanchal,2008* reported that the results obtained from the barley supplemented biscuits, on the initial day, the samples recorded high scores for all evaluated as like same criteria with overall acceptability (7.8). At 15th day the overall acceptability was (7.6). On 30th day of observation the overall acceptability was (7.4). So there is a mild put down in the biscuits. The results showed that the cookies and the barley supplemented biscuits can be stored up to 30 days at room temperatures. Based on these effects the bamboo rice biscuits can also be stored up to 30 days.

Proximate analysis

The nutrient content of the gluten free biscuits were given in table 5.

TABLE: 5 NUTRIENT CONTENT OF GLUTEN FREE BISCUITS

Nutrients (units)	Gluten free biscuits
Energy (kcal)	197.5±0.5
Protein (g)	32.2±0.2
Fat (g)	6.3±0.15
Carbohydrate (g)	2.27±0.01
Fiber (g)	4.3±0.2

The gluten free biscuits were analysed for nutrient content in which energy, protein, fat, carbohydrate and fiber were 197.5 kcal, 32.2g, 6.3g, 2.27g and 4.3g respectively. Whereas in the quinoa biscuits the energy, protein, fat, carbohydrate and fiber were 464 kcal, 8.51g, 21.3g, 59.9g and 3.12g per 100gram respectively (*Anam 2018*). According to *Krishnan et al., 2011* the finger millet seed coat biscuits the energy, protein, fat, carbohydrate and fiber were 484 kcal, 8.9g, 12.5g, 66.8g, and 5.7g respectively. While comparing with the above study gluten free biscuits has rich in protein and fiber since bamboo rice is rich in protein and fiber content, thus preventing constipation and low in energy, fat and carbohydrate which can be given for the overweight and diabetic patients.

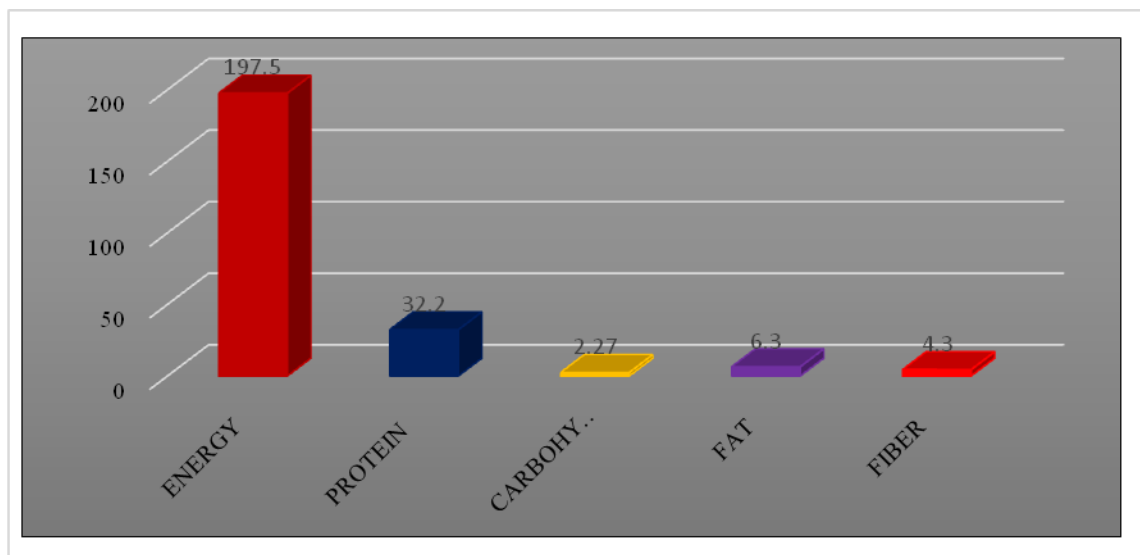


FIGURE 2: NUTRIENT CONTENT OF GLUTEN FREE BISCUITS

Cost calculation

The samples includes the cost of bamboo rice, green gram dal, butter. Processing costs for the experimental biscuits include cost calculation of electricity charges, labour charges. For manufacturing of 1 kg of biscuits on an average, the total cost of production was Rs.290 and for 100g it was Rs.29

Whereas in the cost of production of wheat flour biscuits was found to be Rs.45.41/kg. Among the different cereal bran biscuits, wheat bran biscuits had lesser cost Rs. 42.52/kg, whereas oat bran biscuits had higher cost of Rs.43.22/kg. The cost of the cereal bran biscuits ranged from Rs. 42.51 to 43.22/kg (*Nagi et al., 2012*). Hence the cost for the gluten free biscuits was the high cost when compared with the other biscuits this is due to the addition of bamboo rice and green gram dhal.

CONCLUSION

In the present study concluded that the development of gluten free biscuits has high acceptances. However, the biscuits prepared by using 70 percent bamboo rice and 30 percent green gram dhal (T3) had the striking advantage of cost production and sensory quality. It contained 197.5 kcal, 32.2 gram protein, 6.3 gram fat, 2.27 gram carbohydrate, 4.3 gram fiber, 13.35 gram ash, 6.6 gram moisture. The product are microbial safe to consume. Gluten free homemade biscuits are indigenous, the process of selection of wholesome ingredients is carefully monitored. It is free from preservatives and additives. It is safe to consume for any age group. Thus the formulated gluten free biscuits is a viable solution for celiac disease with nutrient dense characteristics.

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