SPROUTED PULSES INCROPORATION ON PHYSICAL CHARACTERISTICS AND SENSORY EVALUATION OF BISCUITS

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Abstract

The aim of the present study is to investigate the effect of incorporating sprouted pulses on physical characteristics and sensory evaluation on biscuits.

Sprouting is one of the important processing techniques to improve the nutritional significance of green gram, gram and utilizing it for the protein-rich infant food formulations. Sprouting process break down the large compound into simple compound which is make it biscuit easy to digestible and highly nutritive. The process also breaks down the enzyme inhibitors present in the pulses making it much easier for the body to digest and absorb the nutrients. Sprouting also increases the nutritional content and makes it more bioactive.

In this study, biscuits are made by sprouted green gram flour and sprouted gram flour blending with refined flour and other ingredients. We have tried to determine the optimum level of flour substitution that would give an acceptable biscuit by sensory parameters. A blend of sprouted green gram and gram flour with concentrations of 10%, 20%, 30% and 40% and 50 % along with of refined flour were used for development of biscuits.

During our study, we observed that although any of the recorded concentration of sprouted flour is resulting in acceptable biscuits by sensory parameters, increasing concentration of sprouted flour in biscuits are resulting in darker color. We have also observed that increasing concentration of sprouted flour is increasing water absorption of biscuits and resulting in higher spread ratio.

Keywords: sprouting. green gram. Gram. sensory evaluation. physical characteristics

INTRODUCTION

Biscuit is a widely consumed and popular snack food. Attempts have been made to improve the nutritional quality of biscuit. Good eating quality makes biscuits attractive for protein fortification and other nutritional improvements. Fortification of foods is of current interest because of nutritional awareness of consumers. All biscuits are nutritional's, contributing valuable quantities of iron, calcium, protein, calorie, fibre and some of the B-vitamins to our diet and daily food requirement. Supplementation with pulses is one way to meet the needs for protein. Composite flour has the added advantage of improving the nutrient value of biscuits and other bakery products especially when cereals are blended with pulses e.g., green gram and Bengal gram/gram. As a pulses, Green gram and Bengal gram is high in protein that play important role in human nutrition. It contains crude protein, fiber and vitamins which makes an excellent source of supplementing proteins in the diet

Earlier the main cause of malnutrition among children was due to protein deficiency. As well as the prevalence of protein energy malnutrition, these children also suffer from other deficiencies like vitamin A, calcium, iron, riboflavin, etc. It may be wise policy to add these nutrients in supplementary food at sufficient concentrations, to make good the deficit in their habitual diets. So, we have challenge now to feed properly to this 'India in childhood stage. Dietary supplements are being designed and produced to meet nutritional demand of children. Among ready-to-eat snacks, biscuits possess several attractive features including wider consumption base, relatively long shelf-life, more convenience, and good eating quality. Long shelf-life of biscuits makes large scale production and distribution possible. Biscuit belongs to the flour confectionery. Such qualities of food products make large scale production and distribution possible, in the shorted period.

Green gram and Bengal gram has high vitamin and mineral. It also has a high content of crude fiber and high level of amino acids which are limited in cereals. These compositions gave Green gram and Bengal gram its high nutritive and health value. Legumes are vital source of dietary protein for large sector of the world's population. Legumes are high in protein and minerals More ever. Green gram is a protein rich staple food. It contains 25 per cent protein, which is almost three times that of cereals. It supplies protein requirement of vegetarian population of the country. Green gram is a very nutritious food rich in high grade vitamin B1 and B2, iron and proteins.

Nowadays, there is a trend to formulate foods with cereal flour to raise their nutritional value, because foods with only refined flour give more health complications. This study was carried out to evaluate the feasibility of incorporating sprouted Green gram (mung bean) flour and sprouted Bengal gram flour into refined flour to prepare a biscuit with an adequate nutritional profile.

Composite flours (CF) using cereals, legumes, millets, soy-protein isolate, dairy ingredient and fruit without refined flour were used for preparing multi-nutrient biscuits. Dough and biscuits were evaluated for physical, nutritional and textural properties, particle size, colour and sensory evaluation and compared against refined-flour biscuits (C). Effect of malting and sprouting on biscuit quality were also analyzed. The highest volume of particles for CF was 140 µm higher than C flour. CF biscuits had significantly ($p \leq 0.05$) lower spread ratio and % weight loss compared to C. The hardness, stickiness and cohesiveness values of CF doughs were significantly ($p \leq 0.05$) lower than C resulting in lower cutting strength and increased hardness of CF biscuits. Sprouting further decreased hardness of CF dough. Nutrient content of CF biscuits (sprouted and unsprouted) were significantly ($p \leq 0.05$) higher than C biscuits. Sensory evaluation showed CF biscuits especially with sprouted flour had higher acceptability and were superior to C. (Agrahar-Murugkar, et

al 2015).

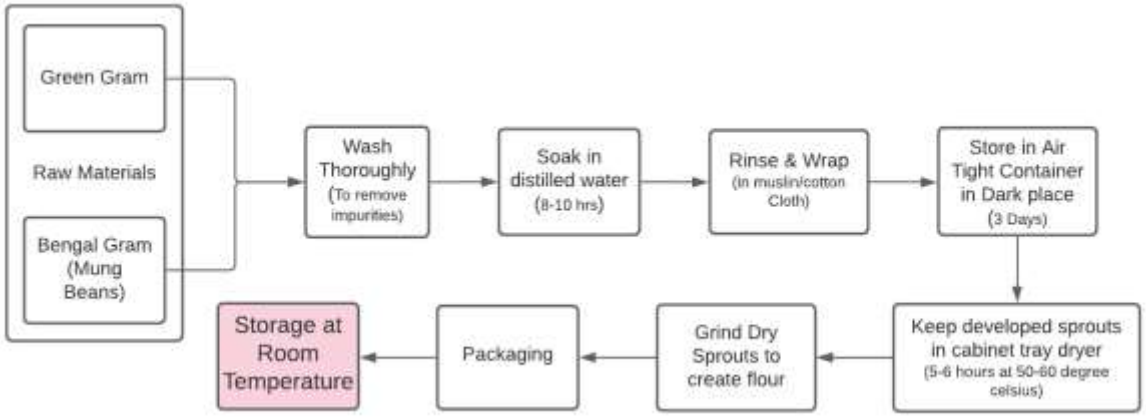
The aim of the present study is to investigate the effect of physical treatments (ultra-sonication and warm water) on the overall sprouting and malting of green gram. Green gram samples on ultra-sonication (US) for 30 min and warm water (WW) treatment for 15 min had showed highest sprouting percentage of 99% (in 16 hr) and 98.5% (in 14 hr), respectively. Further, freeze-dried malt presented the highest protein content. Lower protein content in tray dried malt indicates the degradation of protein during drying. In addition, WW treated, and radio frequency dried (RFD) sample showed the highest in vitro protein digestibility (86.18%) and protein efficiency ratio (1.24). In conclusion, among all the pre-treatments, WW treatment followed by RFD can be consider as best way to accelerate the malting process while retaining the protein quality, hence such protein rich malt will be more beneficial for the food sectors focusing on the infant food formulations (Tilekar Rasika Dattatray,et al 2019) Effect of pre-treatments on sprouting rate and nutritional quality of green gram (Vigna radiata L.) malt

MATERIALS AND METHODS

Source of raw materials

Good Quality Green Gram (Mung Bean or Moong) Botanical name: **Vigna radiata L. Wildzek**, and Gram (Chickpea or Chick Pea or Bengal Gram) Botanical name: ***Cicer arietinum*** was purchased from local market. The food items viz. refined flour, sugar, butter, baking powder, baking soda were also purchased from local market, Jhansi, UP.

Preparation of sprouted flour (Flow Chart)



Preparation of blends from sprouted green gram, gram and refined flour

Table 1: Blending ratio of refined flour, sprouted green gram flour and sprouted gram flour.

Sample code	Refined Flour	Sprouted gram flour	Sprouted Green Gram flour
T1	90	5	5
T2	80	10	10
T3	70	15	15
T4	60	20	20
T5	50	25	25

Preparation of biscuits

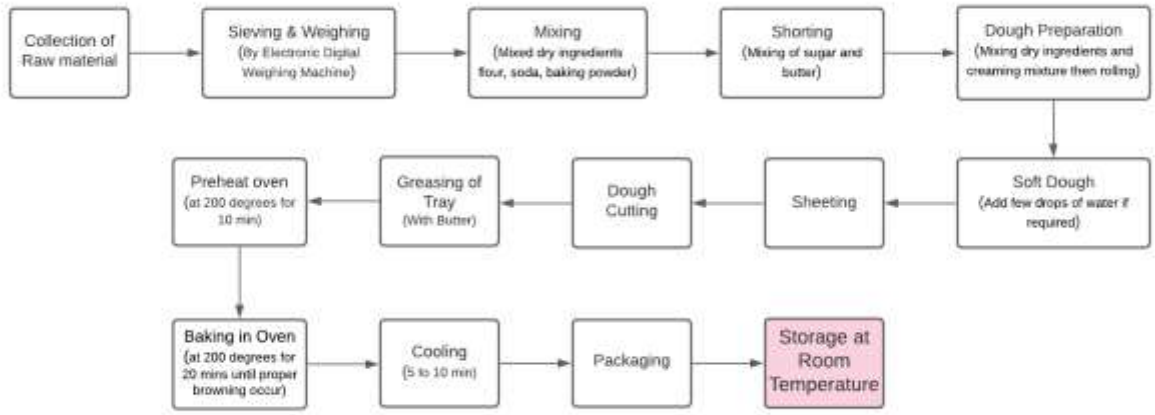
The biscuits were formulated according to the recipe given by Whitley (1970) [27] with slight modifications. The ingredients used for biscuit making have been listed in Table 2.

Table 2: Experimental baking formula for biscuits

S. No.	Items	10.00%	20.00%	30.00%	40.00%	50.00%
1	**Refined Flour**	90	80	70	60	50
2	**Sprouted Gram Flour**	5	10	15	20	25
3	**Sprouted Mung Flour**	5	10	15	20	25
4	**Baking Powder**	2 Gram	2 Gram	2 Gram	2 Gram	2 Gram
5	**Baking soda**	2 Gram	2 Gram	2 Gram	2 Gram	2 Gram
6	**Water**	In drops as required for soft dough	In drops as required for soft dough	In drops as required for soft dough	In drops as required for soft dough	In drops as required for soft dough
7	**Sugar**	60	60	60	60	60
8	**Butter**	50	50	50	50	50

The traditional creaming method was used for the preparation of biscuits. Fat and sugar were mixed in a mixer until the mixture became light fluffy. Into the mixture, composite flour (refined flour, sprouted green gram flour and sprouted gram flour) and other ingredients i.e., Baking powder, baking soda were added and all the components were mixed thoroughly. Water was added to the flour mixture and it was kneaded lightly to make a soft dough. The dough was rolled out into sheets using a rolling pin and cut into the circular shape using a biscuit cutter. The cut mass was transferred to a greased baking tray and baking was carried out at 200 °C for 20 min. After cooling, biscuits were packed in high density polyethylene jar and stored at ambient temperature for various determinations

Flow Chart for Biscuit Preparation



Determination of the Physical Characteristics of Biscuits

The physical properties of biscuits viz. weight, thickness, diameter and spread ratio were evaluated by the method described by AACC (1967)

1. **Thickness** was measured by stacking six biscuits on top of each other, measuring the thickness using vernier calliper, restacking in a different order and remeasuring them to get the average thickness in millimetre.
2. **Diameter** of biscuits was determined by placing six biscuit samples edge to edge and measuring with a digital vernier caliper. An average of six values was taken for each set of samples. Average value for diameter was reported in millimeter. The biscuits were rotated at an angle of 90° and their diameter was measured again to check the accuracy.
3. **Weight** of biscuits was measured as average values of six individual biscuits with the help of a digital analytical weighing balance. Average value for weight was reported in grams.
4. **Spread ratio** was determined by dividing width (mm) by thickness (mm). The value for each parameter was recorded in triplicates

Sensory Evaluation of Biscuits

Sensory evaluation of the biscuit samples was carried out for consumer acceptability and preference using semi trained panelist from the Bundelkhand University department of Institute of food technology Jhansi, Uttar Pradesh. Biscuit samples were evaluated for colour, flavour, texture, taste, shape, mouthfeel and overall acceptability using 9-point hedonic scale method.

RESULT AND DISCUSSION

DETERMINATION OF SENSORY PROPERTIES OF BISCUIT

The sensory evaluation of a product helps in determining its quality, market potential, batch-to-batch variation if any, and pricing. It also reduces the chances of product failure (Dubey et al., 2020) [39]. The scores for the sensory parameters of the biscuit samples are presented in Table 4. The biscuit samples varied significantly ($p < .05$) in terms of color, flavour, taste, texture and overall acceptability scores

Colour is an important attribute for consumers, who purchase and consumes any food product, including biscuits, on the basis of their color (Krystyjan et al., 2015) [40]. The color developed during the baking stage can be used to determine the final stage of the baking process. The highest colour score was obtained for the biscuits made from whole wheat flour (8.57) followed by biscuits prepared by substitution of 5 per cent (8.07) and 10 per cent (7.93) horse gram flour respectively. The score for colour was lowest for 30 per cent horse gram flour supplemented biscuits (6.9). The study revealed that colour scores decreased with increasing incorporation of horse gram flour with whole wheat flour. The biscuits with higher proportion of horse gram flour were significantly darker, mainly due to the darker color of the horse gram flour. The dark colour of the legumes and wheat bran from whole wheat flour play a significant role in term of biscuit colour. Also, the composite flour biscuits may be darker in colour due to maillard reactions between reducing

sugar and amino acids which forms high-molecular weight macromolecule called melanoidins during baking (Morales and Jimenez-Perez, 2001; Krystyjan et al., 2015)

Table 3 Sensory parameters of the biscuit samples

Sample Set	Colour	Taste	Texture	Shape	Mouthfeel	Crunchiness	Overall
T1	41	46	39	46	41	44	43
T2	39	43	46	48	42	42	43
T3	43	46	48	48	42	47	45
T4	44	47	45	50	47	49	47
T5	47	45	46	49	42	47	46

DETERMINATION OF PHYSICAL PROPERTIES OF BISCUIT

Table 4 Physical properties of biscuit sample

Sample Set	Diameter	Thickness	Weight	Spread Ratio
T1	53.18 ± 1.53	8.33 ± 0.02	10.42 ± 0.56	6.38 ± 0.18
T2	55.77 ± 0.95	8.01 ± 0.06	11.22 ± 1.75	6.97 ± 0.14
T3	54.4 ± 0.48	7.47 ± 0.07	10.53 ± 1.33	7.28 ± 0.12
T4	54.7 ± 1.11	7.68 ± 0.07	10.45 ± 0.55	7.12 ± 0.13
T5	56.15 ± 1.03	8.01 ± 0.07	11.27 ± 1.51	7.01 ± 0.19

CONCLUSION

Sprouting significantly improved nutritional. Present study shows that sprouting is an effective method for improving nutritional factors in biscuits.

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CONFLICT OF INTEREST

The authors have declared no conflicts of interest for this article.

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