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A STUDY ON DEVELOPMENT ON SWEET POTATO BASED GLUTEN FREE COOKIES AND ITS SENSORY ANALYSES

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ABSTRCT

Sweet potato is among the world's most important and under-exploited crop. It is commonly referred to as subsistence, food security or famine relief crop; its uses have diversified considerably in the developing countries. This article emphasizes principle and method of nutritional cookies production, its extended shelf life, physicochemical parameters and also rheological analyses. Sensory evaluation explains that gluten free treatment with 1:1 ratio of sweet potato to pulses were acceptable from the consumer's point of view.

The aim of the present work is to replace wheat flour in cookies with rice flour and sweet potato for pasting in order to develop gluten-free cookies targeting a good sensory acceptance and quality parameters.

KEYWORDS: Cookies, sweet potato, gluten free products, celiac disease, fortification, shelf life, sensory parameters.

INTRODUCTION

Cookies, among the bakery products, are most significant in the world. These are an important food product used as snacks by children and adults [1]. Cookies differ from other baked products like bread and cakes because of their low moisture content which ensures that they are free from microbial spoilage and confer a long shelf life on the product [2]. Long shelf life of cookies makes large scale production and distribution possible. Good eating quality makes them attractive for fortification and other nutritional improvement. Fortification is done up to some level to meet following objectives; to maintain the nutritional quality of foods, keeping nutrients levels adequate to correct or prevent specific nutritional deficiencies in the population or in groups at risk of certain deficiencies, to increase the added nutritional value of a product (commercial view) and to provide certain technological functions in food processing [3]. Substitution‖ refers to completely replacing certain ingredient with some other suitable ingredient especially done in cases where a particular ingredient is

allergen. In the present study wheat is being replaced by sweet potato and rice in preparation of gluten free sweet potato cookies. The reason being wheat contains gluten (a special type of protein that is commonly found in rye, wheat, and barley) which causes a disease called, Celiac [4]. Celiac disease (CD) is a permanent inflammatory disease of the small intestine triggered by the ingestion of gluten containing cereals. It is an immune-mediated disorder that affects primarily the gastrointestinal tract. Complete avoidance of gluten enables the intestine to heal, and the nutritional deficiencies and other symptoms to resolve. Children tend to heal more quickly than adults [5].

In the present study, sweet potato is used to replace wheat is highly nutritious and rich in fiber, vitamins, and minerals and antioxidants. It is classified as a functional food, because it provides health benefits beyond its nutritional content.

AIMS OF THE STUDY

There are no such cookies (rice and sweet potato substituting wheat) available commercially. Till now there are products (cookies, biscuits) which are fortified with rice flour and sweet potato for fiber or other purposes but within particular ranges blended with different kind of flour. The study was carried out with following objectives:

To develop gluten free cookies for celiac patients.

To assess sweet potato as main bakery ingredient by substitution of wheat flour with rice flour.

To standardize the recipe for preparation of sweet potato based gluten free cookies and evaluation of nutritional, sensory and textural quality of cookies.

MATERIALS AND METHODS

In order to prepare the cakes and cookies, the following materials have been purchased from local market Barrackpore, West Bengal, India: rice flour (RF), lentil, black gram and Bengal gram, butter, fresh whole eggs, refined oil, milk, vanilla essence, honey, baking powder, powdered sugar, sodium bicarbonate, salt and xanthan gum.

Cookie Preparation. Cookies were made by the dough according a homemade cookie recipe. A resting period of 15 min at room temperature was given to the prepared dough. Then sheets were formed. It was then moulded and dropped on the baking tray. Then the tray is placed in cake oven for baking. After baking for 15 min, the tray was taken out, cooled and the cookies were ready [6]. For each treatment, three series replicates were produced.

The samples were marked as T1, T2, T3, T4, T5. All of the samples were kept under ambient temperature.

Physicochemical Analysis. Moisture, ash and acid soluble ash contents were measured in cookies by AACC method, 2000 [7].

Sensory Analysis. The sensory parameters of different cakes and cookies were carried out by 50 panelists. The panelists were asked to evaluate the products based on taste, aroma, color, texture, appearance and overall acceptability. The evaluation was based on 9-point hedonic scale ranging from 9 (extremely good) to 5 (extremely disgusted) for each organoleptic characteristic. Bottled water at room temperature was provided to clean the palate between the treatments to have the correct result [8].

Statistical Analysis. Statistical analyses were per- formed by using SPSS software (ver. 22) (IBM Corporation, Somers, NY). Data were presented as M ±SD and analyzed by the ANOVA. Duncan's multiple range test was used to determine significance between means. Differences at $p < 0.05$ were considered to be significant.

RESULTS

Physicochemical Attributes. Moisture content influences mechanical strength (crumbliness) and crunchiness of cookies and cakes. Comparative studies shown in Table 1, the control has the lowest moisture content (35.5%) compared to other treatments ($p < 0.05$). Furthermore, T1 showed the highest moisture content (51%) among all treatments ($p < 0.05$). It can be attributed to the high protein and fiber content in Bazra and Ragi and the presence of hydroxyl groups that enhanced the capability of interaction with water molecules and thus increased moisture content. Sweet potato (SP) exhibited higher water holding capacity than other GF flours. Bakery product volume is a crucial factor influencing consumer acceptability. Similarly, the ash and acid soluble ash contents were found to be increased in Bazra and Ragi made cookies and cakes compared to the sweet potato ingredient.

TABLE 1. PHYSICOCHEMICAL ANALYSES OF GLUTEN FREE COOKIES

Sample	Ingredient	Moisture (%)	Ash (%)	Acid insoluble ash (%)
T1	Bajra: Dry Peas = 1:1	4.26	2.44	1.04
T2	Rice flour: Sweet potato = 2:1	5.41	2.43	1.05
T3	Rice flour: Sweet potato = 1:1	12.68	2.43	1.34

The experiment was carried out in triplicate.

Sensory Properties. GF products exhibit different appearances, colors, texture, aroma, and taste compared to wheat flour products. Generally, GF bakery products exhibit lower sensory acceptability due to the undesirable appearance, darker color, more complex texture, and dry sandy feeling in the mouth [9]. Results illustrated in Table 2, that incorporating gluten replacers in cookie formulation had little influence ($p < 0.05$) on different treatments' flavor and chewing ability. The lowest scores were recorded in control and T2 concerning firmness, while the highest values were those of T3 and T5. The control and T4 showed the lowest overall acceptability, while T6 received the highest score ($p < 0.05$).

TABLE 2: SENSORY EVALUATION OF DEVELOPED COOKIES

PRODUCTS	SAMPLES	ATTRIBUTES					
		TASTE	AROMA	COLOUR	TEXTURE	APPEARANCE	OVERALL ACCEPTIBILITY
COOKIES	Control	7.15± 0.84 [a]	6.23 ± 1.16 [a]	7.86 ± 0.71 [a]	6.16 ± 0.75 [a]	7.35 ± 0.65 [a]	8.30 ± 0.73 [a]

T1	8.15± 0.24 [a]	6.38 ± 0.86 [a]	7.26 ± 1.35 [a]	8.16 ± 0.05 [a]	7.66 ± 1.35 [a]	8.30 ± 0.73 [a]
T2	7.95± 1.14 [a]	7.63 ± 1.32 [a]	8.56 ± 0.25 [a]	7.66 ± 0.35 [a]	8.16 ± 0.95 [a]	8.30 ± 0.73 [a]
T3	7.05± 0.84 [a]	0.63 ± 1.36 [a]	8.16 ± 0.75 [a]	7.26 ± 1.25 [a]	8.36 ± 0.25 [a]	8.30 ± 0.73 [a]
T4	7.95± 0.04 [a]	6.63 ± 1.36 [a]	7.66 ± 0.35 [a]	7.56 ± 0.35 [a]	7.86 ± 0.95 [a]	7.30 ± 0.73 [a]

Means followed by different lowercase letters within a column are significantly different ($p < 0.05$). A higher value indicates higher overall acceptability. It is to be noted that, sample T5 was not up to the mark for consumer's acceptance based on its sensory evaluation, that's why, the sensory values was not provided in the said table.

DISCUSSION AND CONCLUSION

During the present investigation no significant difference was found in the percent moisture content, and ash content was observed on increasing the incorporation of rice flour in the treatments (i.e., T1, T2, T3, T4 etc). In the present study the formulation was based on different ratios like 1:1, 1:2, 2:1, 3:2 of sweet potato, grains and pulse grain blend. The moisture content of cookies increased linearly with increase in concentration of pulses. The ash content of cookies increased significantly due to externally added fat during preparation.

From sensory evaluation, it has been suggested that cookies fortified with sweet potato and pulse in the ratio of 1:1 showed the better consistency and overall acceptability. Overall, it can be concluded that, GF cookies were acceptable by the consumers.

ECONOMIC IMPORTANCE OF GLUTEN FREE (GF) COOKIES

People who are sensitive to gluten, they will be helpful for consuming such cookies naturally fortified with easy available ingredients which are economically accessible compared to the present market hike of the food products.

FUTURE ASPECT OF THE STUDY

In the pilot scale, we had developed the GF cookies that have consumer's acceptability, therefore, in the large scale production it might have industrial acceptability.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

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