

Development and Standardization of Gluten Free Food Products Using Millets for the Gluten Sensitive Patients

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Abstract

Gluten sensitivity is a disorder where the body reacts badly when eating gluten-containing foods. Gluten is a protein found in wheat, barley, rye. Ingestion of these protein leads to many medical complications. This auto immune condition that involves the immune system reacting to gluten is called Celiac disease. The only treatment available for the most of the celiac patients is to adhere to the gluten exclusion diet throughout their life. So the gluten free diet is necessary to reduce the incidence of celiac disease. Hence this study was designed develop foods products using millets which are gluten free and also excellent source of many nutrients. The product was prepared such as Potato smiley and Rasagula by utilizing the gluten free millets. This study result revealed that the Millets not only protect from gluten sensitivities but also provide all other essential micro- and macronutrients required for the human health.

Key words: Gluten sensitivity, Celiac disease, Millets, Food products

Gluten, which is now an almost ubiquitous ingredient in the food industry, is implicated in several immune-mediated disorders, such as celiac disease (CD) and other intolerances are of increasing concern (Evans *et al.* 2017). It leads to the demand of gluten-free food products by the people who suffer from gluten- related diseases such as wheat allergies, gluten ataxia, non-celiac gluten sensitivity, wheat- dependent, exercise-induced anaphylaxis (WDEIA), and the most well-known, celiac disease. At present, "going gluten-free" is often viewed as a healthy lifestyle choice instead of an appropriate and necessary dietary treatment for a specific condition, namely celiac disease (CD). Consequently, the market for gluten-free products is steadily growing. The Food and Drug Administration (FDA) started to require the labeling of gluten-free products in 2013. Gluten-free mania ballooned the related global industry to a \$3.5 billion per year figure with a forecast of \$4.7 billion in 2020 (Eastwood, 2017).

Millet is a gluten-free and low-cost cereal (approximately 40% lower than the price of corn), which is resistant to drought and nutrient-poor soils (Gomes *et al.* 2008). Millet is a superior cereal with regard to nutritional quality and presents several health benefits (Krishnan *et al.*, 2011). Millets help in the management of various disorders like diabetes mellitus, obesity, hyperlipidaemia, etc. (Veena, 2003). It is a rich source of phytochemicals with nutraceutical potential. Moreover, millet is a staple food substitute for celiac patients who require gluten-free cereal. Thus, the aim of this study was to develop food products using Jowar (*Sorghum bicolor*) and Pearl millet (*Pennisetum glaucum*) millet flour and evaluate

their sensory and microbiological quality to provide novel and alternative gluten-free products. The objective of the study is to:

- Prepare the millets Jowar and Pearl millet flour.
- Determine the gluten content of millet flour.
- Develop and standardize the gluten free food products from the selected millet flour through sensory evaluation.
- Analyze the microbial load and cost of the millet incorporated food products.

MATERIALS AND METHODS

Collection of raw materials

The millets such as Jowar (*Sorghum bicolor*) and Pearl millet (*Pennisetum glaucum*) procured from local market in virudhunagar.

Preparation of millets flour

The purchased millets were dried in cabinet drier at 63°C and then powdered using electrical mixer.

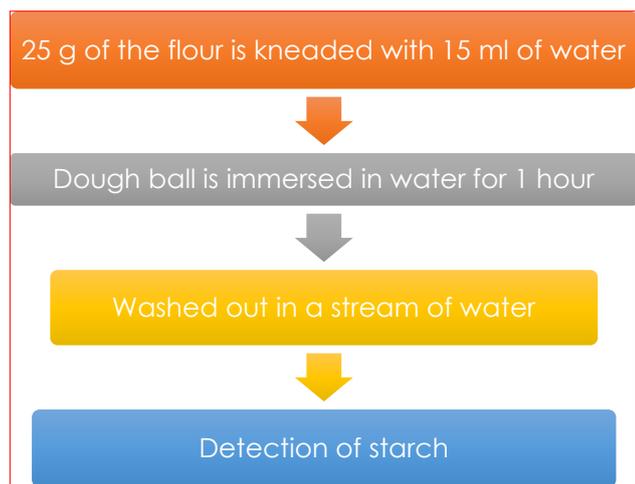
Estimation of Gluten content

The gluten content of millets flours estimated by using standard method. Given in the flow (Chart 1).

Development of Millet based gluten free food products

In the present study recipes were standardized and developed by the use of Gluten Free millets viz. Jowar

(*Sorghum bicolor*) and Pearl millet (*Pennisetum glaucum*). Control sample was prepared from the usual recipes.



Flow Chart 1- Determination of gluten content

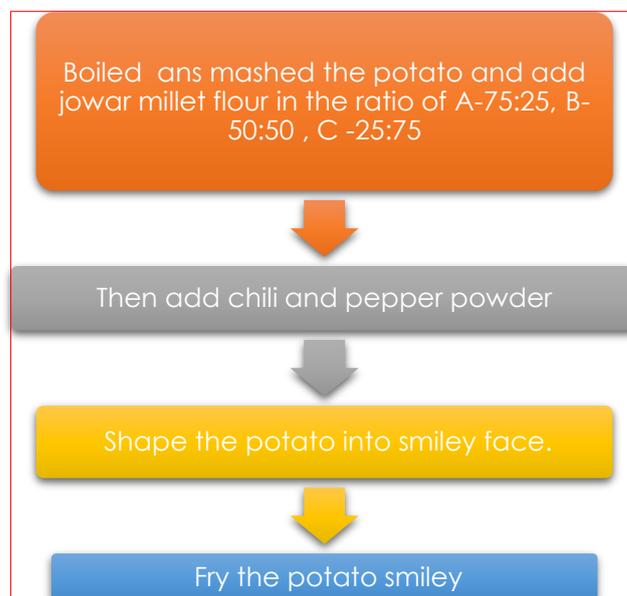


Figure 2 Preparation of potato smiley using Jowar

Standardization of pearl millet flour incorporated Rasagula

Table 1 Ingredients used for the preparation of pearl Rasagula

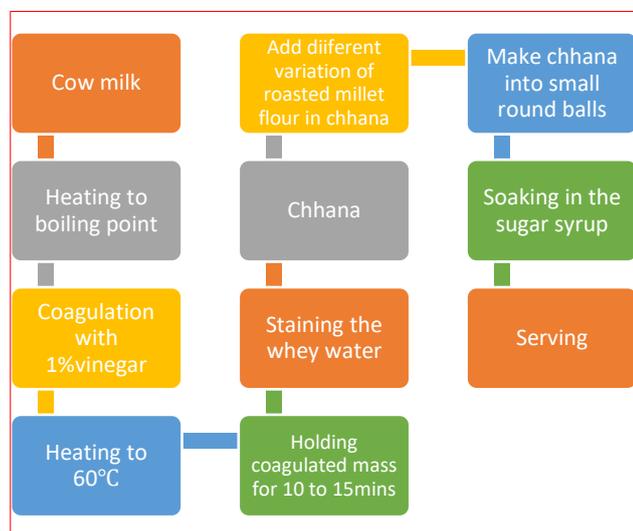
| Ingredients | Control | Sample A | Sample B | Sample C |
|--------------------|---------|----------|----------|----------|
| Milk chhana | 100 gm | 100gm | 100 gm | 100 gm |
| Pearl millet flour | - | 10gm | 20gm | 30gm |
| Vinegar | 2tsp | 2tsp | 2tsp | 2tsp |
| Sugar | 50 g | 50 g | 50 g | 50 g |

Microbiological analysis millet incorporated food products

Samples (10 g) of millet-based products were suspended in sterile 90 ml distilled water tubes and serially diluted (ten-fold dilution). Petri plates with nutrient agar for bacteria, EMB agar for E. Coli count and Potato Dextrose Agar for Total mould count were prepared. Dilution (1 ml) of 10^{-7} was inoculated on sterile disposable Petri dishes using pour plate method. The plates were then incubated appropriately to allow growth of organisms (Oluwole *et al.* 2014).

Table 2 Ingredients used for the preparation of jowar incorporated Potato smiley

| Ingredients | Control | Sample A | Sample B | Sample C |
|--------------------|---------|----------|----------|----------|
| Potato | 100 | 75 | 50 | 25 |
| Jowar millet flour | - | 25 | 50 | 75 |
| Chili powder | 2tsp | 2tsp | 2tsp | 2tsp |
| Pepper | 1tsp | 1tsp | 1tsp | 1tsp |
| Salt | 2tsp | 2tsp | 2tsp | 2tsp |



Flow Chart 2- Preparation of pearl millet Rasagula

RESULTS AND DISCUSSION

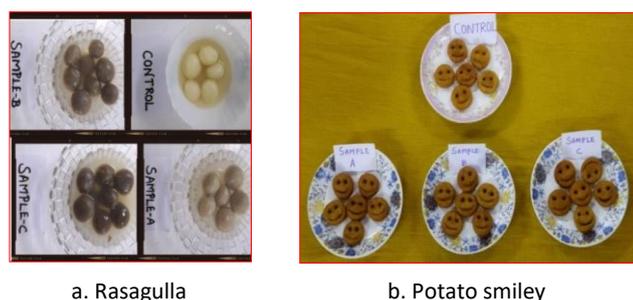
Determination of Gluten content

Sorghum (*Sorghum bicolor*) and Pearl millet (*Pennisetum glaucum*) were selected for this study. The gluten content was estimated in the pearl millet and Jowar. The results revealed that there is no gluten content in these millets. This report was supported by Fajardo *et al.* (2020). From his Gluten free cereals database, it was found that sorghum (*Sorghum bicolor*) and Pearl millet (*Pennisetum glaucum*) products are consumed by individuals experiencing gluten related disorders.

Sensory evaluation of Millets incorporated foods

The Pearl millet and Sorghum incorporated foods were prepared. Sensory valuation of the product was done on the basis of 5-point hedonic scale. The sensory evaluation scores were depicted in the (Figure 1-2).

Sensory evaluation enables to understand the person's reaction to the food products that are perceived by senses and to scientifically evaluate the product according the attributes. (Figure 1) shows that the sensory evaluation of the control and Pearl millet incorporated Rasagula (10%, 20%, and 30%) using



a. Rasagulla

b. Potato smiley

Standardization of Jowar incorporated potato smiley

5 point hedonic scale. From this result it was revealed that the sample B which contained 20% pearl millet was found to be acceptable than the other Rasagula samples.

The sensory evaluation of Jowar based potato smiley results (Figure 2) indicated that, the overall acceptability of potato smiley with 50% sorghum found to be the best

acceptable formulation. Galassi (2020) highlighted that use of sorghum has a high nutrient potential and it can be safely consumed by people with celiac disease. Adiamo *et al.* (2018) also recommended the pearl millets as an alternative diet to people with gluten intolerance and celiac disease related challenge.

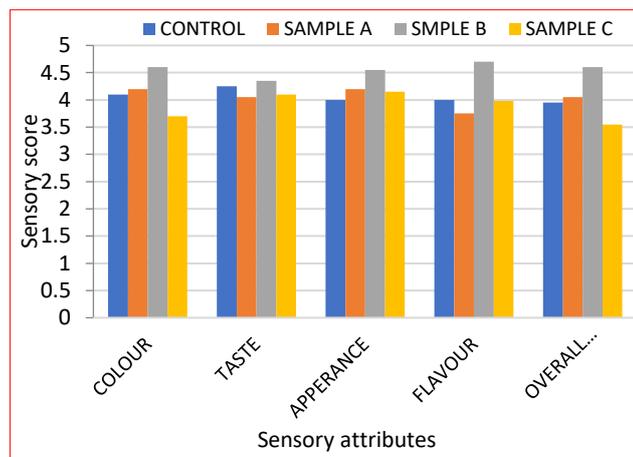


Figure 1 Sensory evaluation of Rasagulla

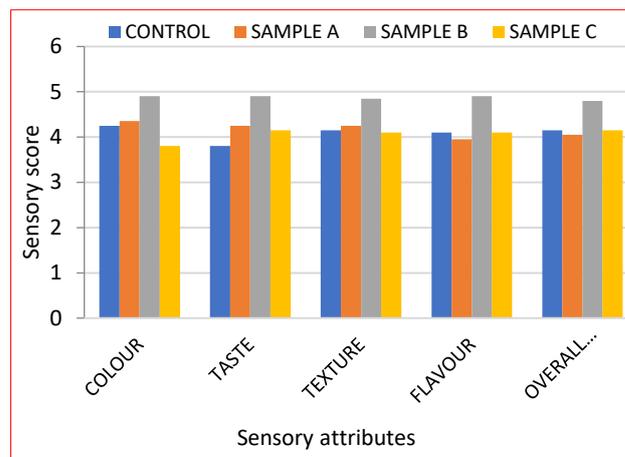


Figure 2 Sensory evaluation of Potato smiley

Microbial profile of the millet incorporated products

Microbial load of control and selected millet incorporated products done by Total Plate Count Method. Total bacteria count, mould and coliforms were not detected in all the millets incorporated potato smiley and Rasagula samples on day 0 and day 1.

Cost analysis

The cost of 100 gm Jowar based potato smiley was Rs.30 and 200gm pearl millet incorporated Rasagula was Rs. 44.

CONCLUSION

Millets are rightly termed as ‘miracle grains’ or the ‘crops of the future’ as they have greater potential to cater the needs of gluten sensitive population, addressing the nutritional imbalance which is otherwise an issue with some gluten free foods. Nowadays many people depend on the absence of gluten in the diet. The present study result concluded that it is possible to develop a gluten-free product using Sorghum (*Sorghum bicolor*) and Pearl millet (*Pennisetum glaucum*). The millets can provide a healthy life to the people who are in the need of gluten free diet.

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