Development of Gluten Free Pasta by Formulation Based on Composite of Rice and Maize Flour

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ABSTRACT

Obtaining gluten-free products of similar characteristics to wheat-based products is a difficult task and because of this, over the last decades extensive research has been done to produce gluten-free products with similar characteristics. Gluten (wheat proteins) found majorly in wheat and in some other cereals that contributes in formation of dough structure and bonding by making peptide linkages. If these linkages can't hydrolyze by body so it shows the absence of related enzyme which is responsible for gastrointestinal disorders. Gluten intolerance is so common now. Researchers are working on food products for celiac patient and working on rheological along with sensorial properties of food product are so challenging task. Formation of gluten free pasta without being using the flour has no gluten content is difficult to form because of lack of structured protein. Although nontraditional ingredients could change the rheological property or sensory preferences, so adequate and reliable technological process must be used and adopted to formulate such pasta. Many researches have carried out on different blends. The aim of this study is to determine the rheological and sensorial property of pasta based on composite flour i-e 75% rice flour and 25% maize flour which are rich with bioactive components and effects of xanthan gum on texture of pasta.

Keywords: Gluten, xanthan gum, gluten intolerance, gastrointestinal disorders, rheological property.

INTRODUCTION

Celiac disease is a very serious genetic immune disease that usually damages the villi occurs in small intestine that reduce the absorption of other essential nutrient that are required by body for daily life functioning that's why in can increase the number of risk and diseases if isn't controlled , it is increasing due to continues use of gluten contain foods (cereal) and enhance the risk chances as infertility , reduction in bone density so cause osteoporosis and osteomalasia, neurological disorders , deficiency of mineral and vitamins cause several problems and some other immune disorders (Jnawali *et al.,* 2016).

If villi of intestine damages so reduces the absorption of micronutrients on mucosa layer so over all intestinal function disturbed and the lining of intestine is effective which reduce the supportive and absorptive function of digestive system in which different symptom occur vary person to person i.e. symptom of celiac disease in children is different from adults symptom as foul-smelling diarrhea, vomiting, emaciation, anemia, and muscle stiffness. It is different from a non-celiac gluten sensitivity (Tanwar *et al.,* 2006).

There are many rice based processed foods have been developed, among them, rice noodles and rice cakes are two major rice based processed foods in which rice flour is the main ingredient (Makdoud *et al.,* 2017). Rice bread is also very important rice based product and it can be made by using 100% rice flour. The main reason behind selection of rice flour for our product is that it is gluten free and considered best for peoples who are suffering from celiac disease and gluten intolerance (Diantom *et al.,* 2016).

Maize is one of the most broadly cultivated grains among cereals. It is produced and cultivated among many countries of the world such as USA, China, Brazil, America, Mexico, Indonesia and France. It is used as staple food among many countries. Earlier it was only used as animal feed but now it is utilized in different forms such as flour, grits, starch and various cereal products (Rouf Shah *et al.,* 2016).It is now used as an alternative to wheat and rice as it is third most popular cereal crop. It is also gluten free so it is a good source of nutrients for the people that are gluten intolerant. It has great health benefits such as it can lowers stomach acidity, decreases constipation and has ability to fight against certain cancers. Maize has prolamins (predominant is zeina) glutenin and globulin proteins by which gluten network is not formed. It has plenty of fiber, vitamin B1, phosphorous and magnesium.

Pasta is the combination of flour (starch and proteins) and water in the presence of eggs, oil and other components to modify the dough by passing from a long tube in a desirable shape, than used for consumption after cooking or boiling to serve with seasoning (Chandra *et al.,* 2015). There are unique combinations of properties of pasta as cheap, ease of preparation, nutritive value, delicious, feasibility and high shelf life ensures that it continues to play a role as world demand to increase cereals usage (Deshpande *et al.,* 2011). The aim of this research paper to produce gluten free pasta by blend of rich and maize flour to obtain the precise quality attributes as gluten pasta.

MATERIAL AND METHOD:

Flour collection:

As this product based on maize and rice flour that taken from Imtiaz super mart who supplies own flour by the name of POONAM. Cleaning is done by sieving to remove extraneous matter and other contaminates.

Test on gluten free composite flour:

Wet Gluten Test:

This test is performed to check gluten in dough. Gluten is a protein that is mainly found in wheat flour that gives stretchability and viscosity to dough. The principle is based on rinsing the prepared dough under running tap water and rubbery mass which is gluten. And this test shows negative result so no gluten content present in composite flour (Czuchajowska *et al.,* 1996).

Stickiness Test:

Stickiness is major property of gluten containing flour, due to the interaction of gluten with water. The test is carried out by dissolving flour in dilute HCL followed by dilute NaOH (Zhiying *et al.,* 2015).

Moisture Content:

It basically the amount of moisture content present in any sample, for flour it should be less than 14%. The moisture is analyzed by moisture analyzer in which weight loss occur by heating the sample by infrared rays, so that water evaporates and result is expressed by moisture loss. (AACC 2000).

Water Absorption test on flour:

It could be affected by amount of damaged starch in flour. The measured amount of flour is mixed in water, mixture was filtered and water absorption is calculated by measuring amount of filtrates (Dodds *et al.,* 1971).

Solvent Retention Capacity:

Solvent retention capacity is a physical test by which we determine the flour's functionality and level of damaged starch in flour by the help of solvents such as water, lactic acid, sugar solution and sodium carbonate (Guzmán *et al.,* 2015).

Phytochemical Screening Test:

It is a qualitative test, which determines only the presence of phytochemicals which are saponin, terpenoid, alkaloid, flavonoid, reducing sugar and steroid (Pathak *et al.,* 2015).

Unit Density Test:

Unit density is the ratio of mass and volume in which volume is determined by measuring length and diameter of pasta. Diameter directly related to cooking time; greater the diameter, greater will be the cooking time (Haraldsson, J. 2010).

Water Absorption Test on pasta:

The test based on the amount of water absorbed by sample under specific conditions.

Optimal Cooking Time:

It is basically the time required to cook a product under specific conditions (Borneo *et al.,* 2008).

Bulk Density:

It is measured by measuring the mass of sample in a particular volume. It is basically the mass of bulk amount of solids that settles in a specific volume (Subramanian *et al.,* 2007).

Water Holding Capacity:

Water holding capacity of pasta determines ability of pasta to hold the amount of water on exertion of any external force or applying any processing (Lusicano 2012).

Texture Analysis:

Texture analysis is done by texture analyzer. This can measured the force required for deforming by applying pressure through a probe (Haraldsson, J. 2010).

Swelling Capacity:

Swelling capacity indicates the ability of starch present in product to absorb or up take water to swell (Haraldsson, J. 2010).

Sensory Test: (Pagliarini 1994).

- Hedonic
- Numeric scoring:
- Paired comparison:

Nutrition Profile:

- Ash
- Protein
- Fat
- Carbohydrate

RESULT

Phytochemical screening of composite flour (Qualitative test)

	Starch	Reducin g Sugar	Tannin s	Phytat e	Steroids	Alkaloids	Glycoside s	Flavanoids
Control	+++	++	-----	-----	-----	-----	+	++
Sample	+++	++	-----	-----	-----	-----	---	++

+++ Strong intensity,
++ Medium intensity,
+ Weak intensity,
--- Absent.

General Test:

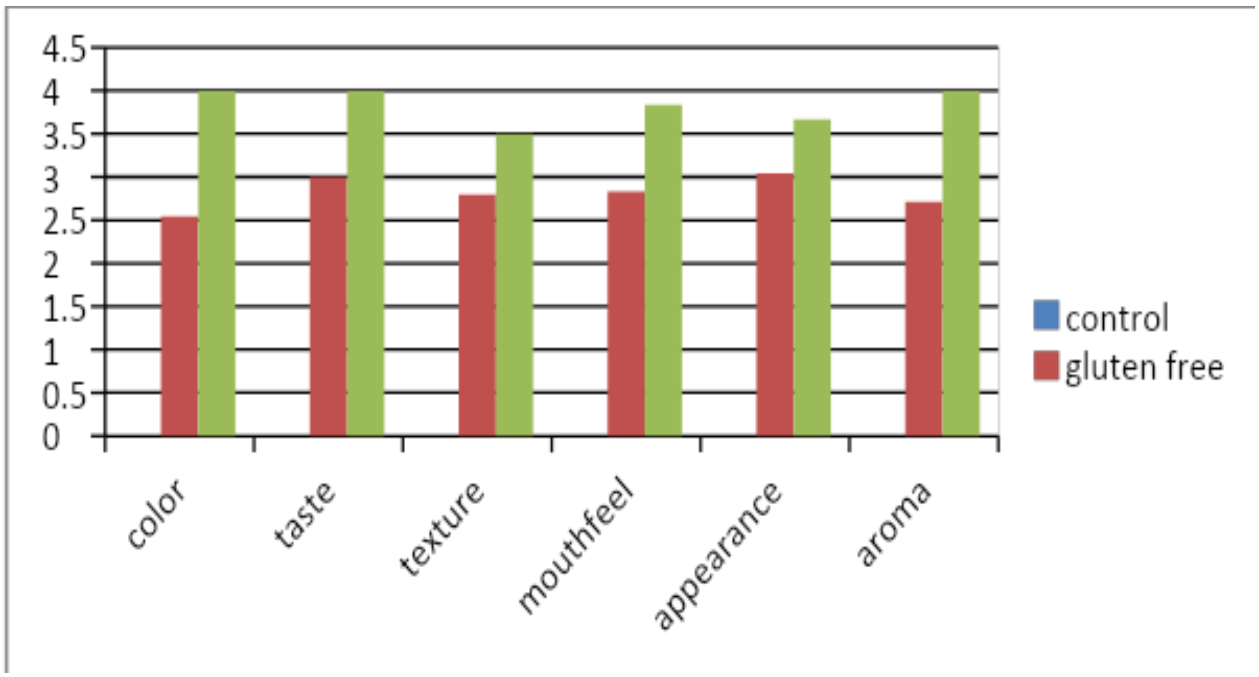
	Composite flour	Control
Moisture Content	8.93%	10.15%
Bulk density	0.4386 gm/ml	0.4225 gm/ml
Water holding capacity	121.59	121.43
Texture	33.23	30.33
Cooking time	30.26 min	20.26 min
Unit density	8.428 gm/cm^3	4.726 gm/cm^3
Ash content	3.05%	1.4%
Fat content	0.9%	1.1%
Water absorption	254.17%	152.5%
Protein	29.96%	20.29%

Physical Parameter:

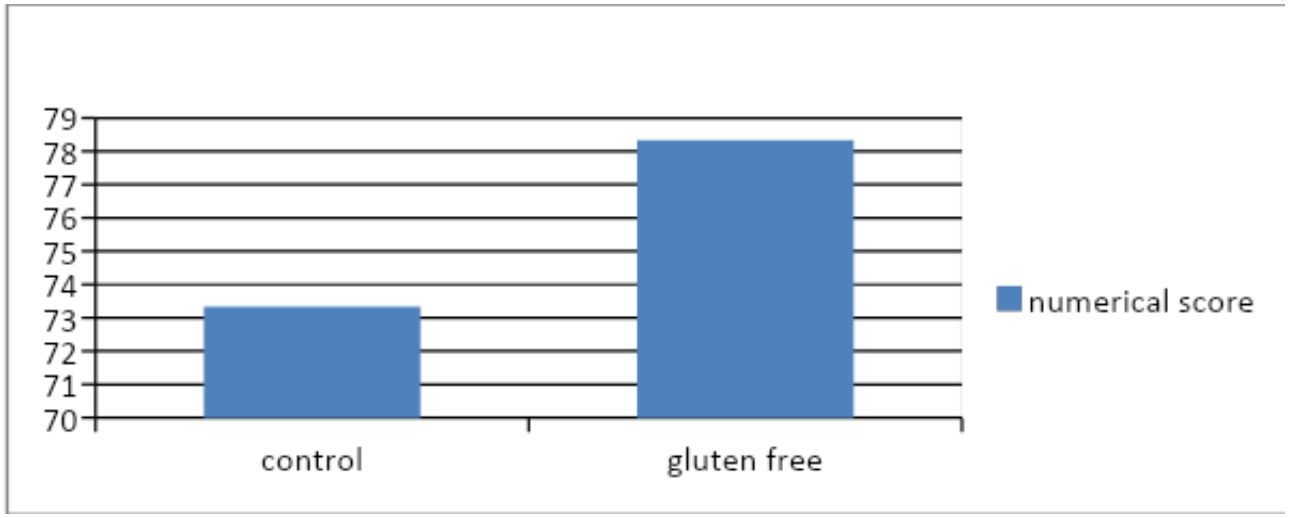
	Diameter	Length
Control pasta	0.183 mm	12.3 inches
Gluten free pasta	0.134 mm	11.96 inches

Sensory evolution:

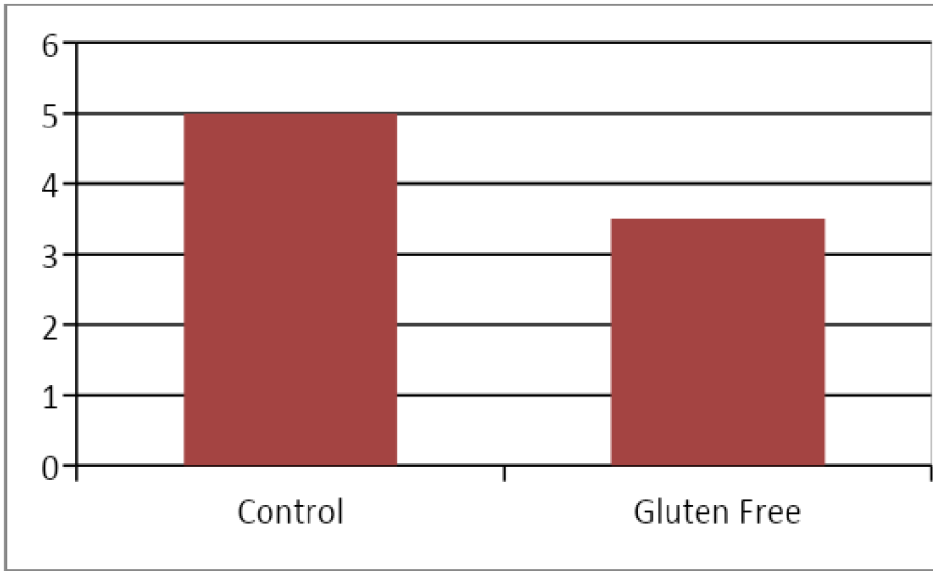
Hedonic Rating Test Result:



Numeric Scoring Test Result:



Paired Comparison Test Result:



CONCLUSION

The main purpose of this study is to make gluten free pasta product using rice and maize flour and assuring good quality parameters even in the absence of gluten. The aim is to make a product that can be easily consumed by celiac patients because these patients are not able to tolerate a protein that is called as gluten. Celiac disease is a disease by which the small intestines can damage of an individual and the absorption of the nutrients is affected. If a celiac patient follows a gluten free diet than the symptoms of this disease will improve. The textural and sensorial properties of gluten free food products especially the gluten free pasta products are highly affected due to the absence of gluten. Now day's different methods used to make the quality of gluten free products better. Many flours used as an alternate and some additives also used in order to improve the quality of gluten free pasta products.

Gluten free formulation is not an easy task because different gluten free grains shows different quality attributes which can affect overall quality of the product. Rice flour is used more predominantly in gluten free products

as alone or as in a combination with other flours. In gluten free pasta products the use of hydrocolloids is also very important because they help in improving the cooking behavior and most importantly the firm texture of the pasta products. We use xanthan gum in our gluten free pasta in order to improve the stability and it also facilitate processing. We observe that the use of egg protein can help to maintain the internal structure of gluten free pasta. Some quality characteristics still need improvements such as texture because the sticky texture observed. We made our gluten free pasta by using 75% rice flour and 25% maize flour and it was also observed as acceptable in case of taste, texture and color. The egg was considered as the most important ingredient which can make the quality characteristics especially the texture of gluten free pasta better. More research should be performing in the future in order to improve some weaknesses of this research. Major Improvement in this study can occur by improving the texture of gluten free pasta. The market value of gluten free pasta can be increased by improving the elasticity, stickiness, color and losses that occurs during cooking.

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