World Journal of Medical Sciences 11 (3): 306-311, 2014
ISSN 1817-3055

DOI: 10.5829/idosi.wjms.2014.11.3.84264

Novelty Formulas of Free Gluten Flat Bread for *Coeliac* Disease Patients

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Abstract: Produce of gluten free flat bread similar to conventional flat bread quality aimed by this study to formulate two free-gluten recipes to produce flat bread. Different trials carried out for predicting the best formulas. Therefore the two formulas composed of rice, corn, potato starch; milk, whey powder, plant oil, yeast, salt, sugar, sodium bicarbonate and guar gum were chosen in two different recipes for production of gluten-free flat bread. The data analysis showed that the dough performed reasonably well dough handling and flatting during bread making. The percentages of Potato starch, rice and corn have positive correlations at P-value < 0.005 affect rheological properties of gluten free flat bread. Nutritionally, inclusion of potato starch had more energy and increase protein contents. Sensory evaluation data indicated that of flat bread seem to be highly accepted when they were assessed by patients and patients' mothers. It can be concluded that, it is possible to create free-gluten bread with similar conventional bread quality.

Key words: Coeliac Disease · Free-Gluten · Flat · Bread formulas

INTRODUCTION

Coeliac disease (CD) is an autoimmune and chronic disorder in which the mucous membrane of the small intestine is damaged in gluten- intolerant individuals. CD is caused not only by a reaction to gliadin in wheat prolamin but also high molecular glutenin and subunits of gluten protein consequents in damage and inflammation to the small intestine and causes malnutrition [1-3]. One person out of two hindered has been diagnosed with this disease and some studies have stated that the dominant of this disease is 1 in 100 worldwide [4, 5]. This chronic disease is recognized as long-life disease and the only solution is adherence stickiness to gluten-free products. But this is not easy as many foodstuffs contain gluten [2].

The raising of CD or gluten intolerance and allergic has encouraged the technologists and food professionals to create gluten-free food products. A number of gluten-free breads have been developed in order to replace conventional wheat bread. Furthermore, over the past few decades, a there has been in several studies to create gluten free-products which are mainly comprised of maize, rice flour mixed with cassava maize, chickpea flour, wheat or potato starch with the involvement of some other ingredients such as emulsifiers, hydrocolloids, diary products, prebiotics in the purpose of improving quality and palatability of gluten-free products. However, creating and/or developing gluten-free products is not an easy approach since gluten is a predominant ingredients in breading making which confers elasticity and extensibility for the dough and very important to the quality of the end-product [6, 7].

Bread is a staple diet that is consumed daily and its quality and sensory attributes are highly considered by consumers. But the quality of the gluten-free bread might different than conventional heat bread due to luck of gluten. So to compensate that, different ingredients have been used to such; tapioca and corn starch are used despite their technical and sensorial problems in bread making. Rice flour is also used and preferred because of having no gluten and easily digested polysaccharides. Also, Hydrocolloids are used in gluten

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free products to impart desirable technical properties [2]. Egg and dairy constituents can also be used to improve the sensory attributes and quality bread both technically and nutritionally [8].

Bread making could be prepared from starch and gel-forming substances. Rice starches are widely available and offer potential in the formulation of gluten-free baked products. Absence of gluten, low levels of sodium and high amounts of easily digested carbohydrate are all properties of rice, which are desirable for special diets [9].

A study of the influence of sensory characteristic of gluten free bread mad from rice, maize and tapioca flours, found that the bread were considered acceptable in terms of sensory attributes [10]. Another study has stated that gluten free bread produced from rice flour, Cassava starch and corn starch was assessed sensorial by some experts and. It was observed that the bread considered successful [11].

Middle Eastern countries and many of families in the world now consume the flat bread type. In general, flat bread is a simple formula produced by a few ingredients. It is carriers either by incorporating foods such as meat or vegetables in the dough or as final products in which food can be placed in the pocket of the two layer flat bread. A correct balance of visco-elastic properties is an important during flat bread making [12]. Flat bread are typically round in shape, bread diameters range from 5 to 20 inch), while their thickness may thin or thick in one inch; the crust is very thin and light with brown or dark spots. Crumb is small in quantity, coarse and intense with a low specific volume white creamy color of bread crumb [12]. The aim of this work to invent and to offer a formula for making gluten-free flat bread can be produced by bakeries and families that consume pocket type flat bread. This will give the CD patients good feeling when they take the meals with their families by eating similar bread not a special diet or different type.

MATERIAL AND METHODS

Free Gluten Flat Bread Making: All ingredients used in flat bread making were chosen after many trials to finalize the following two formulas as in Table 1. The dough was mixed using a local stainless steel mixer for 10 mints to obtain the dough. Flat bread was made following the method mentioned as in [12] Flat Bread; ingredients and fortification (Review).

Dough Tests: Water Absorption (%), Peak time (min.), Stability time (min.) and Mixing Tolerance Index (BU) were determined using a Farinograph (Brabender OHG, Duisburg, Germany) according to AACC 54-21 method, constant flour weight procedure. Dough extensibility (mm),Resistance to extension (BU) and Ratio were determined using an extensograph (Brabender OHG, Duisburg, Germany) according to AACC 54-10 method [13].

Bread Analysis: The ingredients were determined based on 100 g flat bread. Moisture of flour was determined following the method suggested by AACC 44-15A method [13]. Ash determined by the AACC 08-3 method. Protein of flour was determined by Micro-Kjeldahl method following AACC 46-13. Lipids content was determined using Soxhlet extraction according AACC 30-25.01[13]. Water activity was measured using Novasina Lab Touch-aw, Switzerland. Energy (Kcal) was determined using a bomb calorimeter.

Sensory Evaluation: The breads were evaluated by 16 patients and patients' mothers for testing the overall acceptability, flavor, odor, texture, appearance and tenderness using hedonic scales. The panelists were asked to rate the samples for all of these parameters on a nine hedonic scales where 1=dislike extremely; 2=dislike very much; 3 dislike moderately; 4=dislike slightly; 5= neither like nor dislike; 6=like slightly; 7= like moderately; 8= 1ike very much and 9=like extremely [14].

Statistical Analyses: Values in the text and tables are expressed as Means of the three measurements. Experiments were performed in three replicates and the data analyses and Correlations were performed using SAS software [15]. LSD tests for significant differences at $P \leq 0.05$ between the breads.

Table 1: Two different recipes for gluten free bread making

	Rice flour	Corn flour	Potato starch	Skim Milk powder	Whey powder	Guar gum	Yeast	Salt	Sodium bicarbonate	Plant oil	Sugar
Recipe 1	40%	30 %	10 %	5 %	5 %	3 %	1.5 %	1.5 %	1.5 %	1.5 %	1
Recipe 2	45%	35 %	0%	5 %	5 %	3 %	1.5 %	1.5 %	1.5 %	1.5 %	1

RESULTS AND DISCUSSION

Dough Rheology Properties: The rheological and quality properties of gluten free breads are presented in Table 2. The data pointed out the changing the proportion of rice flour, corn flour and potato could change dough rheological properties. It seems that water absorption is greater in the recipe 1. Additionally, the recipe1 showed a higher mixing tolerance. In contract, recipe 2 showed more stability, more extensible and resistance to extension. This could be related to the presence of potato starch in the recipe 1 which could have a great affinity towards water particularly when it is been pressurized [16]. Since theses starches competes to absorb more moisture and then gelatinize. Furthermore, it can be seen that adding different starch sources could make the dough less stable and less extensible. It could be due the presence of different starch with different gelatinization and hydration degree. It has also been found that corn flour showed a lower gelatinization property comparing some other flours [17]. As mentioned earlier, having different types of starch from various sources such as rice, cassava and potato starch could make the starches gelatinize differently and make the dough less to be less resistant to extension. But the recipe 2 seems to be more convenient in terms of visco-elastic properties and dough rheology.

Bread Analysis: The chemical composition of bread from both recipes is presented in Table 3. It is can be seen that all, the parameters seem to be higher for the recipe 1 bread. To ensure that gluten-free bread is acceptable, products with baked and sensory characteristics similar to those of wheat flour yeast bread are needed.

Sensory Evaluation: The sensory evaluation was conducted according to ranking tests which was developed for assessing the food products acceptability, in which higher the score indicates to higher acceptability and quality. The results indicated that in the patients' point of view, the attributed of the recipe 2 scored higher results and had better results. This implies that the recipe 2 gluten free bread showed better performance and has a better quality. These findings agreed with the strong correlation between a product's acceptability and sensory parameter such as appearance, texture, flavor….etc [18].

Records showed similar results which they preferred the attributes of the recipe 2 flat bread except appearance and tenderness which was lower than the recipe 1. It is evident that texture in both of bread cored the highest record and was extremely accepted by the patients But, interestingly the attributes of the both breads showed that both breads are successful to

Table 2: the rheological properties of gluten free flat bread

	Water Absorption (%)	Peak time (min.)	Stability time (min.)	Mixing Tolerance Index (BU)	Dough extensibility (mm)	Resistance to extension(BU)	Ratio
Recipe 1	65.0^{A}	2^{A}	1^{A}	80^{A}	100^{A}	180^{A}	1.8^{A}
Recipe 2	60.0^{B}	2^{A}	2^{A}	60^{B}	130^{B}	240^{B}	1.85^{A}

*Average of three determinations.

** Means within rows with different letters significantly different according to LSD at P = 0.05.

Table 3: Some of analysis results of gluten free flat bread (100 g)

per 100 g	Moisture %	water activity	Ash%	Protein%	Lipids%	Energy Kcal
Recipe 1	36^{A}	0.95^{A}	3^{A}	11.2^{A}	2.1^{A}	276^{B}
Recipe 2	35^{A}	0.93^{A}	3^{A}	13.1^{B}	1.9^{A}	260^{A}

*Average of three determinations.

** Means within rows with different letters significantly different according to LSD at P = 0.05.

Table 4: The Correlation between Recipe 1 and some of sensory parameters of gluten free flatbread

	Rice flour	Corn flour	Potato starch	Skim Milk powder	Whey powder	Guar gum	Yeast	Salt	Sodium bicarbonate	Plant oil	Sugar
Flavor	0.82S	0.71S	-0.67S	0.55	0.48	0.15	0.58	0.65S	-0.28	0.48	0.65
	0.09	0.1	0.02	0.5	0.4	0.5	0.24	0.3	0.04	0.23	0.11
Appearance	0.92S	0.83S	-0.62S	0.45	0.41	0.47	0.45	0.35	0.35	0.34	0.78 S
	0.04	0.05	0.03	0.06	0.09	0.05	0.36	0.15	0.38	0.76	0.36
Over all	0.9S	0.72S	-0.5	0.42	0.45	0.32	0.52	0.41	0.22	0.49	0.56
	0.01	0.06	0.06	0.1	0.4	0.27	0.23	0.14	0.24	0.32	0.45

^{S}Significant at P-value < 0.005

Table 5: The Correlation between Recipe 2 and some of sensory parameters of gluten free flatbread

Property	Rice flour	Corn flour	Skim Milk powder	Whey powder	Guar gum	Yeast	Salt	Sodium bicarbonate	Plant oil	Sugar
Flavor	0.76S	0.83S	0.45	0.39	0.35	0.61	0.62S	-0.27	0.41	0.55 S
	0.12	0.11	0.45	0.67	0.34	0.24	0.21	0.22	0.23	0.23
Appearance	0.88S	0.86S	0.34	0.52	0.56	0.51	0.41	-0.42	0.43	0.67 S
	0.07	0.13	0.23	0.46	0.15	0.36	0.34	0.04	0.12	0.45
over all	0.80S	0.82S	0.52	0.55	0.45	0.54	0.53	-0.45	0.52	0.65 S
	0.34	0.01	0.33	0.17	0.23	0.03	0.23	0.16	0.3	0.51

[S] Significant at P-value < 0.005

Recipe 1

Recipe 2

Fig 1: the photos of the gluten free-breads made from two different recipes

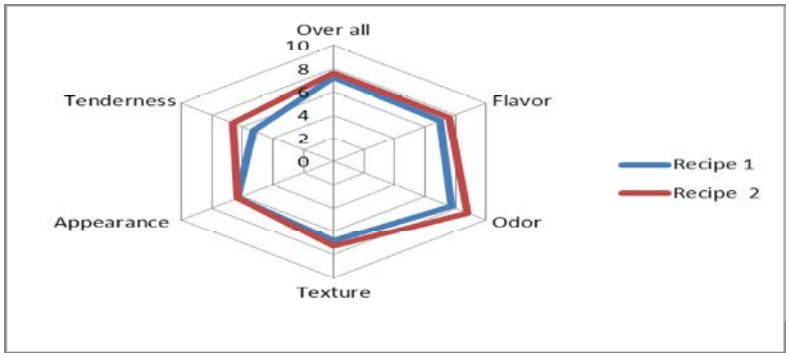

Fig 2: Sensory evaluation of the two breads prepared from two recipes assessed by patients

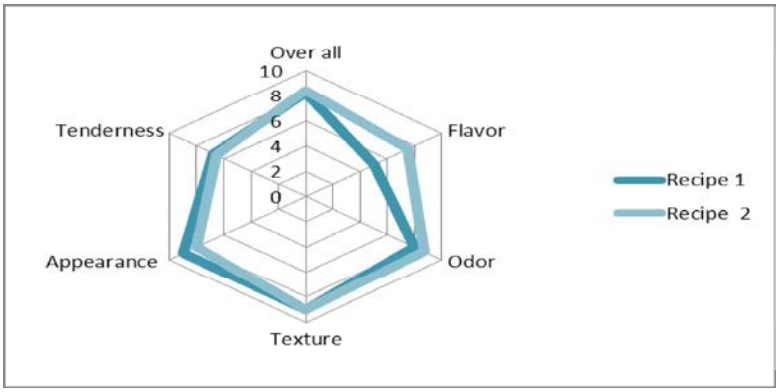

Fig 3. Sensory evaluation of the two breads prepared from two recipes assessed by patient's mothers

satisfy the need of the coeliac patients and their mothers for acceptable flat gluten bread breads since most of the attribute scored much higher than 5 (Figure 2, 3).

To unravel more information and any potential correlation between the ingredients and some sensory parameters, further investigation were carried out. The results of the recipe 1 (Table 4) showed that the addition of rice flour and corn flour is directly related to the flavor, appearance and overall acceptability. However, potato starch seems to have an influence on flavor and appearance. Salt also seems to have connection with flavor. This is quite evident as salt is normally added to give particular flavor to food products. Finally only sugar showed an influence on the appearance of the flat bread. However, for the recipe 2 the influences were a bit different as shown in table 5. Rice flour corn flour was strongly related to the flavor, appearance and overall acceptability. Furthermore, sugar addition was also influenced the three parameters. This might be due to the non-enzymatic browning reaction that might happen during heat process which could give a desirable color and flavor the breads [19]. Finally, similar to the recipe 1, salt again influenced the flavor. So, it most evident that for creating gluten free- bread the addition of these aforementioned should be take into consideration to produce acceptable gluten free breads.

CONCLUSION

Coeliac disease has become a prevalent disease some research highlighted. The only suitable alternative and solution is gluten-free products to replace the conventional products. This work was done to create gluten-free flat bread as alternative to conventional bread using two different recipes. The dough rheology and sensory evolution be patients and patients mother indicated that flat bread from two different recipes were successfully to meet their need regarding the quality. So the dough mixing parameters will usually need to be optimized in particular the duration. The results showed that using rice flour, corn flour and potato starch could be a suitable to produce gluten free flat bread than just using rice flour and corn flour. Based on our results, it can be seen that including or excluding some main ingredients like potato starch or changing the percentage of rice or corn could influence the product dough rheology quality. These parameters also showed their influence on the sensory parameters such as flavor, appearance and over all acceptability. Salt and sugar also could direct correlation with some sensory parameters. Therefore, a proper combination needs to be taken into account to create gluten free flat bread.

REFERENCES

1. López, A.C.B., A.J.G. Pereira and R.G. Junqueira, 2004. Flour mixture of rice flour, corn and cassava starch in the production of gluten-free white bread. Braz. Arch. Biol. Technol., 47: 63-70.
2. Motrena, S.G., M.J. Carvalho, J. Canada, N.B. Alvarenga, F.C. Lidon and P. Elisa Belga, 2011. Characterization of Gluten-free Bread Prepared from Maize, Rice and Tapioca Flours using the Hydrocolloid Seaweed Agar-Agar. Rec. Res. Sci.Tech., 3(8): 64-68.
3. Demirkesen, I., G. Sumnu and S. Sahin, 2013. Quality of gluten-free bread formulations baked in different ovens. Food bioprocess tech., 6: 746-753.
4. Catassi, C. and A. Fasano, 2008. Celiac disease. Curr. Opin. Gastroen., 24: 687-691.
5. Morais, E.C., A.G. Cruz, J.A.F. Faria and H.M.A. Bolini, 2014. Prebiotic gluten-free bread: Sensory profiling and drivers of liking. LWT-Food Sci. Tech., 55: 248-254.

6. Matos, M. and C. Rosell, 2012 a. Relationship between instrumental parameters and sensory characteristics in gluten-free breads. Eur. Food Res. Technol., 235: 107-117.
7. Hegazy, A.I., M.S. Ammar and M.I. Ibrahium, 2009. Production of Egyptian Gluten-Free Bread. World J Dairy Food Sci., 4(2): 123-128.
8. Storck, C.R.E., D.A. Rosa Zavareze, M.A. Gularte, M.C. ELIAS, C.M. Rosell and A.R. Guerra Dias, 2013. Protein enrichment and its effects on gluten-free bread characteristics. LWT-Food Sci. Tech., 53: 346-354.
9. Gallagher, E., T. Gormley and E. Arendt, 2004. Recent advances in the formulation of gluten-free cereal-based products. Trends Food Sci. Tech., 15: 143-152.
10. Alvarenga, N.B., F.C. Lidon, E. Belga, P. Motrena, S. Guerreiro and M.J. Carvalho, 2011. Characterization of Gluten-free Bread Prepared from Maize, Rice and Tapioca Flours using the Hydrocolloid Seaweed Agar-Agar. Rec. Res. Sci.Tech., 3(8): 64-68.
11. Sanchez, H., C. Osella and M.D.L. Torre, 2002. Optimization of Gluten-Free Bread Prepared from Cornstarch, Rice Flour and Cassava Starch. J Food Sci., 67: 416-419.
12. Al-Dmoor, H.M., 2012. Flat bread: ingredients and fortification. Qual Assur Saf Crop., 4(1): 2-8.
13. American Association of Cereal Chemists (AACC), 2000. Approved Methods of the American Association of Cereal Chemists, 11th Ed. AACC. St. Paul, MN. http://methods.aaccnet.org/
14. Lawless, H. and H. Hildegarde, 1999. Sensory Evaluation of food: Principles and Practices. 1st Edn., Springer, ISBN-10: 083421752X, New York, pp: 20-170.
15. SAS, 2008. Institute. SAS user's guide. SAS Institute Inc., Cary, NC. USA.
16. Kawai, K., K. Fukami and K. Yamamoto, 2012. Effect of temperature on gelatinization and retrogradation in high hydrostatic pressure treatment of potato starch-water mixtures. Carbohydr. Polym., 87: 314-321.
17. Torbica, A., M. Hadnađev and T. Dapčević, 2010. Rheological, textural and sensory properties of gluten-free bread formulations based on rice and buckwheat flour. Food hydrocolloid, 24: 626-632.
18. Matos, M.E. and C.M. ROSELL, 2012b. Relationship between instrumental parameters and sensory characteristics in gluten-free breads. Eur. Food Res. Technol., 235: 107-117.
19. Elgeti, D., S.D. Nordlohne, M. Föste, M. Besl, M.H. Linden, V. Heinz, M. Jekle and T. Becker, 2014. Volume and texture improvement of gluten-free bread using quinoa white flour. J Cereal Sci., 59: 41-47.