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GLUTEN FREE BISCUITS IN LOCAL MARKET FROM SIBIU

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ABSTRACT: The study was undertaken to assess the quality and sensory properties of gluten free biscuits (GFB) offered in local market in Sibiu. The chemical, physico-chemical parameters and sensory qualities of biscuits were studied. The result revealed that moisture of GFB is normal (<5-6%), the water activity is under 0.3 for 6 of the samples, the breaking point is 0.878 (B7) and 1.564 (B1) as a result of different ingredient used (mix flour-corn, soya, rice for sample B1, rice-chickpeas flour for sample B7). Sensory qualities were determinate by using the hedonic test and showed that the GFB were well accepted by the consumers.

1. INTRODUCTION

Celiac disease (CD) is an inflammatory disease of small intestine that affects 1:1000-1:2000 [1] and in Europe 1% of people [2], it is caused by the consumption of products that contains gluten. Responsible for CD are the gluten proteins from wheat, barley and rye. Patients with CD have permanent in-tolerance to ingest gluten. [3,4]. Therefore food industry developed biscuits, bread, pasta and other products without gluten to satisfy the demand [5]. Gluten free (GF) products are those with natural absence or acceptable level (<20mg/kg) of gluten (EU 828/2014) [6]. In Europe were made studies and it was found that 94% of products measured and labelled "gluten-free" contained less than 5 ppm of gluten [7]. Companies expand the range of gluten free products and it is showed a 28% annual increase of market in past few years [8].

Biscuits are one of the most consumed baked goods world-wide [9] because they are ready-to-eat, they supply energy to human body and they are consumed as snack during the day.

In Romania 40% from consumers prefer o sweet snack between the main meals of the day and the biscuits and the wafers are the main choices [10]

Their price is still much higher as compared to non-gluten-free biscuits [3] as well as they have limited availability in the market [11]. The average price for common wheat biscuits is 1.54 lei/ 100g product.

The aim of the study was to evaluate the gluten free biscuits in regards to their moisture, alkalinity, total sugar, proteins, water activity, nutritional information on the label and acceptability of the consumers. This work is part of a project to develop new gluten free biscuits, to contribute at the sustainability of this specific industry. The consumers of GFB are looking for biscuits with high nutritional and sensory quality and the new products must fulfil these demands.

2. MATERIALS AND METHODS

8 types of biscuits were chosen by their availability on local market in Sibiu. They were chosen in regard to the level of the ingredients and because they did not have cream or topping.

Table 1. Biscuits sample code

No	Biscuit type	Sample code
1	Crispy biscuits with cereal	B1
2	Biscuits breaks oats&fruits	B2
3	Biscuits breaks oats &chocolate chip	B3
4	Biscuits with spices	B4
5	Biscuits with carob	B5
6	Biscuits with peanuts	B6
7	Biscuits with coffee	B7
8	Chocolate chip cookies	B8

Samples B1, B2, B3, B8 were purchased from hypermarket while samples B4, B5, B6, B7 were purchased from shop with natural products.

Physical evaluation of GFB

Weight of biscuits was weight as average of values of 8 individual biscuits.

Volume of biscuits was determined with the test rape seed displacement and density calculated.

Textural analysis was determinate at speed 5 mm/s with a build-in apparatus using a 1 kg load cell and heavy duty platform. Maximum force was recorded as the hardness.

Chemical characteristics

The moisture content was determined by drying at 130±2^{0}C, 40 min in oven, ash content was determined with the calcinations furnace at 750^{0}C for 8 hours and alkalinity was determinate by neutralizing samples extract with HCl 0.1n in the presence of bromthymol blue [13]. Water activity was measured with Novasina LabMaster aw. Proteins were determined through biuret method and sugar content through reducing method [13].

Sensory evaluation

Biscuits were evaluated for overall acceptability (form/visual aspect, color, smell, taste, moth feel, aftertaste, firmness, crisp, break between teeth, dryness, sweetness and aroma) and the sensory evaluation was using 9 point Hedonic scale: the panel was formed by 10 semitrained judges (4 males and 6 females) which usually consume biscuits. The panelists were asked to

evaluate each attribute applying a hedonic scale of 9 points (where 1-extremely dislike and 9- extremely like). Biscuits samples were served in white plastic plate coded with coded numbers. Water was served for palate cleansing during the examination of biscuits. Panelists had a protocol to follow and they were asked to give notes for every characteristic. Finally mean value was taken for each attribute of a sample.

Results are expressed as mean value of duplicate determination. The sensory evaluation is mean of 10 panelists.

3. RESULTS AND DISCUSSION

All GFB are edible products and were signed with a Crossed Grain symbol; however they were different in terms of appearance (color, size and shape) and list of ingredients.

Table 2. The list of ingredients in GFB

Sample	Flour	Sugar/sweeteners	Fat origin	Specific ingredient	Price, RON/100g
B1	corn, rice, soya	brown sugar, sugar, caramel syrup	palm	-	10.14
B2	oat	Demerara sugar, partially inverted syrup	palm	dried fruits	8.25
B3	oat	sugar, Demerara sugar, partially inverted syrup	palm	chocolate chips	8.25
B4	rice, chickpeas	coconut sugar	coconut	spices	7
B5	rice, chickpeas	coconut sugar	coconut	carob	7
B6	rice, chickpeas	coconut sugar	coconut	peanuts	7
B7	rice, chickpeas	coconut sugar	coconut	ground cofee	7
B8	corn, soya	sugar, maltodextrin	palm	choco chips	8.58

Physical evaluation of GFB

In table 3 it is the result of weight for GFB. The weight ranged between 7.87 and 11.23 g/piece for the GFB. This is because the biscuits have different form (cylinder, rectangular, etc.).

Table 3. Weight of GFB

Sample	B1	B2	B3	B4	B5	B6	B7	B8
Weight, g	11	10.4	10.5	7.9	7.3	8	8	11.2

Density of GFB is presented in figures 1 and was high for samples B4, B5, B6 and B7 due to the chickpeas flour.

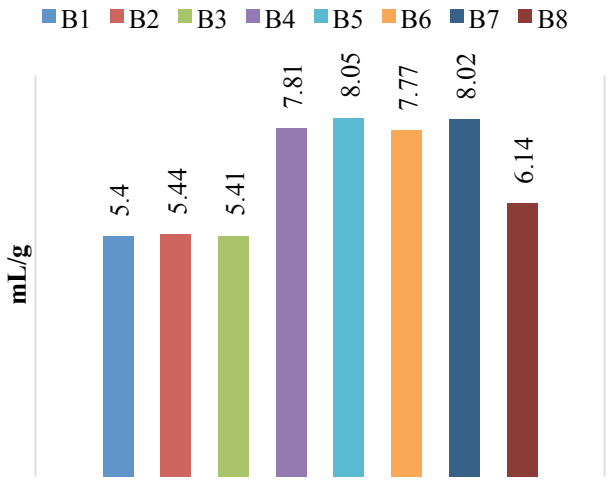

Figure 1. Density of GFB

The smallest density was observed for the sample B1 where the main ingredients were corn and rice flour.

The moisture is important because it influences the shelf life of the products. For biscuit it is recommended to be less than 5% moisture.

During this research significant difference was found in the moisture content and alkalinity. The moisture content of sample biscuits ranged between 2.12% (B8) and 5.86% (B4) while alkalinity, expressed as ml HCl 1n/100 g, ranged between 1.1 (B1) and 4.84 (B7). Alkalinity of the sample B7 was highest and indicate a lower neutralization of sodium bicarbonate in the formulation of biscuits.

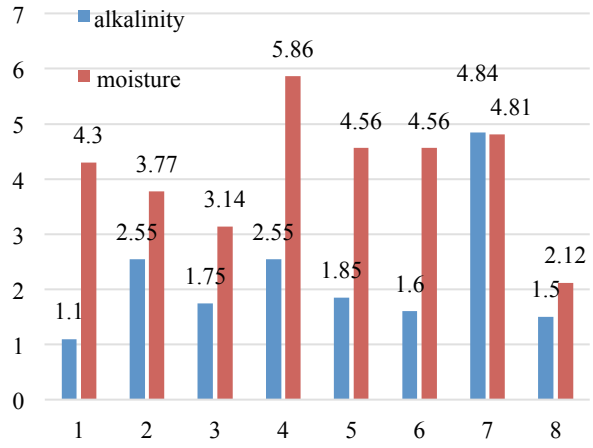

Figure 2. Alkalinity&moisture

Bakery foods with low water activity may be stored with supporting mould growth [12]. Values of water activity lower than 0.7 are needed to stop common microbial spoilage of foods.

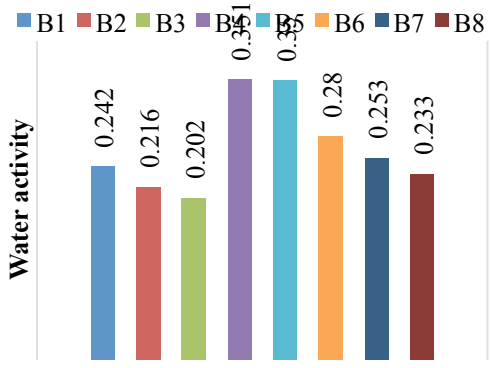

Figure 3. Water activity

In products with water activity <0.3 usually occurs rancidity [12]. Most of the analyzed biscuits shown water activity less than 0.3 or very close to this value (0.35 for B4 and B5). The water content is in relation with water activity but the water content could not be increased more because the biscuits loss theirs crispiness. To increase the stability of biscuits must be selected stable fats for formulation and the use of some antioxidants. Sample B4 had the highest moisture content and showed the highest water activity too. The sample B1 has the lowest water content but did not shown the lowest water activity because the other ingredients (sugars) could influence this property.

The mineral content is considered essentially because in a GF diet it was demonstrated that the patient's organism had a deficit of minerals due bad intestinal absorption. The highest amount of minerals is in sample B7. Sample B7 contains rice and chickpea flour. The chickpea flour has 91.8 mg Ca, 793 mg K, 120 mg Mg and 2.4 mg Na. It is more valuable than oat and corn flour in regard with the mineral content [3], but also the high amount of minerals can be explained by the quantity of salt and chemical leaveners added to the dough.

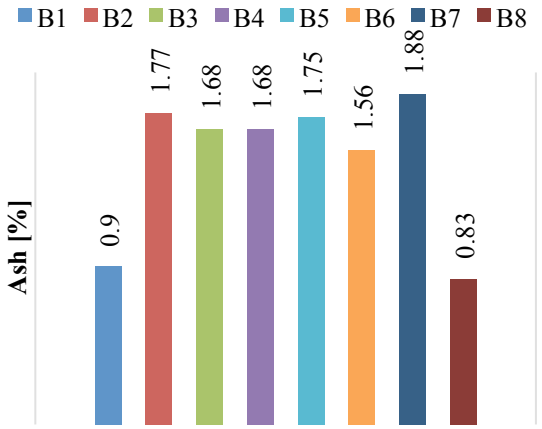

Figure 4. Ash content in GFB

Biscuits breaking points are presented in figure 5. B4 had the lower braking point due to rice flour properties. This sample had average moisture content but the highest water activity. The highest hardness was observed for sample B1 which had the lowest water content.

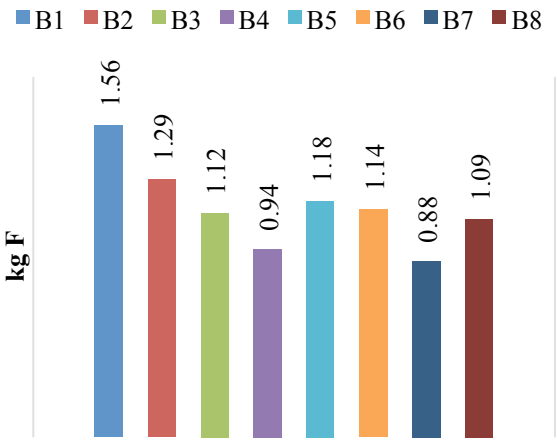

Figure 5. Biscuits hardness, kg Force

In figures 6 are shown the sugar contents of GFB. The higher content was observed at samples B3. The high content of sugar and the type of sugars (inverted syrup) used for formulation contributed to the lowest water activity of biscuit and highest score for sweetness in sensory evaluation. Sample B8 had lowest sugar content but high score for sweetness. This sample was prepared with maltodextrins with low reducing capacity but able to contribute to the sweet taste.

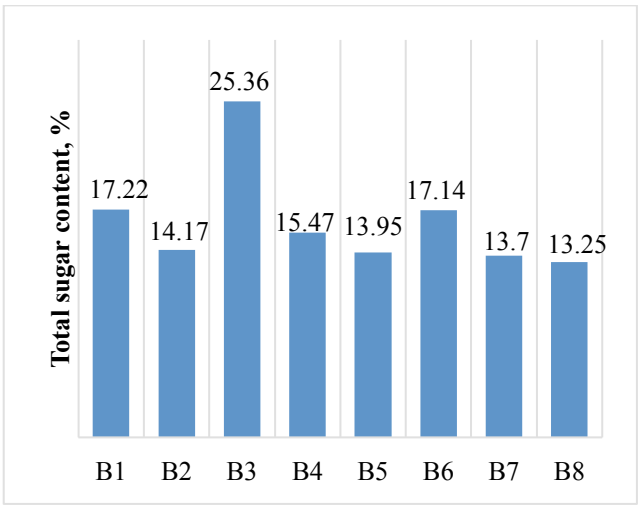

Figure 6. Total sugar in GFB

Protein content of analysed GFB is shown in figures 7. The protein content ranged from 15 to 36 %, lowest for sample B8 and highest for sample B7. It is difficult to estimate the protein content of biscuits because for formulation are used flours from different sources (rice, corn, chickpeas, soya) and also other ingredients as milk, egg, buttermilk, peanuts, soya flour, chocolate. High protein content could be valuable for CD patients because they suffer from malabsorption. Samples B2 and B7 had the highest protein content while sample B8 and B4 had the lowest protein content.

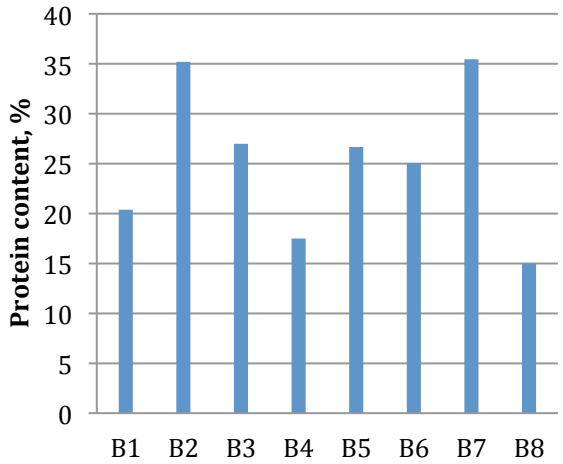

Figure 7. Protein content of GFBs

Sensory evaluation

All analysed GFB were assigned overall acceptability scores by panellists above 5 points, on a scale of 1 to 9 points.

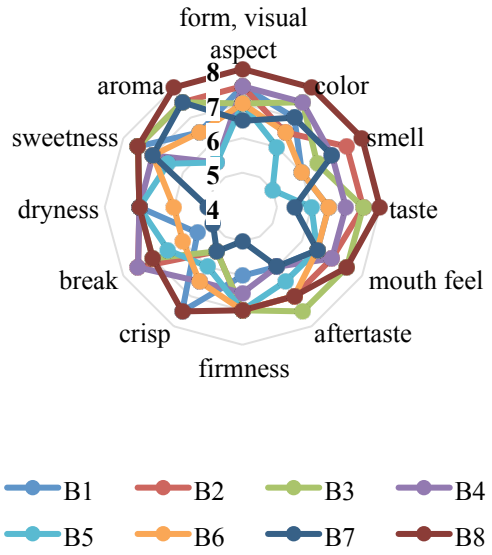

Figure 8. Sensory evaluation of GFBs

Figure 8 showed the evaluation of panellists for overall acceptability. Judging for individual properties panellists had a greater preference for the yellow-brown colour (sugar caramelization and Maillard reaction) with dark points from the chocolate chips (B8) comparative with the dark colour of GFB with carob (B5). Scores for taste were higher for B8 which contains normal sugar and maltodextrin. Scores were lower for 8 characteristics from 12 by the B7 and that is caused by the dark colour of this biscuit which contains ground coffee. Among the 8 samples, the sample B8 recorded the highest acceptability.

4. CONCLUSION

Demand for healthy, natural and functional product in the help of celiac persons is increased and GFB are now available on the market in Sibiu. GFB had similar characteristics with wheat biscuits, the differences pointed out were those of sensory quality. This can be the cause of using different flours without gluten. The appearance of biscuits and the design of health foods should focus on the special age groups such as elders, youths and infants [3]. The price of GFB is still high comparative with wheat biscuits.

Development of gluten free biscuits could contribute increase the sustainability of baking industry by the increasing of health status and comfort of people with CD and by developing of new markets because the consumption of bread and other wheat based product decreased.

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