

Consumers' Acceptance, Satisfaction in Consuming Gluten-free Bread: A Market Survey Approach

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Abstract The market need for good quality gluten-free (GF) bakery products is in focus, due the increasing number of people with Celiac Disease (CD), Non-Celiac Gluten Sensitivity (NCGS) and the growing popularity of following GF diet as a trend. However scientific knowledge of the technically challenging GF bread making is growing, data regarding consumer market needs, opinions, trends and issues are insufficient. The present study was aimed to evaluate the consumer's acceptance of available GF breads and their satisfaction. The data of the study reveal that approximately half of the people following GF diet have other different food related health problems parallel with CD or NCGS. The present study shows, that 70.8% of the asked consumers are dissatisfied with GF breads due their texture and taste, and for home baking consumers usually mix 2-3 or even more different GF flours, as they are displeased with the quality of the available mixes on their own. Overall, the most relevant problem for the consumers is the particularly higher price of the GF flours and breads.

Keywords: Celiac disease, gluten-free, market needs, consumer trends, satisfaction

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1. Introduction

Gluten is a common term used to refer prolamin proteins which are found in wide range of whole grain like wheat (gliadin), barley (hordein) and rye (secalin). Clinically, Celiac Disease (CD) elicits chronic aggravated intestinal inflammation when ingested with gluten containing diet [1,2]. The prevalence of CD among the western counterpart is estimated to be around 1- 1.5 % [3]. In CD the immune mediated response leads to villous atrophy, crypt hyperplasia and nutrient malabsorption [4]. Further, in CD the malabsorption prelude to other secondary complications like Type 1 Diabetes, dermatitis herpetiformis, Crohn-disease, selective IgA deficiency or other autoimmune diseases [5,6,7,8]. Recently, Non-Celiac Gluten Sensitivity (NCGS) is an isolated spectrum of clinical phenotype, which display intestinal and extra intestinal symptoms similar to CD during consumption of gluten or wheat related proteins. However, unlike CD, there are no characteristic histological or serologic abnormalities identified [9]. Currently, GF diet gaining popular attention due to its health effect among the individuals. Recent data suggest that, more than \$15.5 billion were spent on retail sales of gluten-free foods in 2016, which is twice than the amount spent in 2011 [10]. Thus, the mainstay

non-pharmacological intervention for CD or NCGS affected individuals is a strict lifelong GF diet and avoiding the usage of cross contaminated products [11].

Due to the alarming increase in the diagnosis of people with CD or NCGS the market need is expanding for good quality GF products. In baking technology, gluten is a vital structure building protein, containing the protein fraction gliadin and glutenin for leavened baked products and lack of gluten makes a technical and scientific challenge to make good quality GF bread. Lack of gluten in bread preparations leads to more liquid dough and weak gas holding properties [12]. In addition, lack of gluten also elicits adverse bread product like dry, crumbling, concise texture with choky mouthfeel, poor color and shorter shelf life [13,14,15]. Further, the cost of GF breads and flours are generally high [16,17,18]. Meanwhile, a recent survey-based study conducted on Brazilian celiac consumers revealed that they are dissatisfied with GF breads due to lack of variety and texture [19]. However, there is no effective direct link between the scientific work, results and the consumers' satisfaction, habits, needs, priorities regarding commercially available GF foods. In this backdrop, the present study was performed to evaluate the consumers' acceptance of available GF breads and flours, consumers' habits and trends, sentience on overall satisfaction, also identifying those areas that are causing daily problems and/or dissatisfaction among the Hungarian population.

2. Materials and Methods

2.1. Population and Sample

The members from the biggest Hungarian online group on the social media sites, specialized on gathering people following GF diet were invited to participate in this study. The questionnaire was developed and pre-tested among sample of $n = 15$ participants and then registered as an online survey. Number of responders was 500, regularly consuming home baked and/or commercially available convenient bread (baked, sliced and packaged, ready to eat bread), without limitation on age, location within Hungary or income.

2.2. Questionnaire

The questionnaire contained 20 questions and consisted 5 different sections: (1) personal data and reason for GF diet, (2) health status and duration of GF diet, (3) bread consumption habits, (4) satisfaction and problematic areas, (5) consumer trends. In section 4 the overall satisfaction was measured by a 10-point Likert scale, where 0 point was 'absolute dissatisfaction', 5 point was 'eatable, but not good enough' and 10 point was 'absolute satisfied'. Most of the questions were closed-ended questions (dichotomous or multiple choice), and opened-ended

questions in section 4 to reveal those areas, which are an issue for the responder.

2.3. Data Analysis

Means and standard division of the means were calculated using MS Excel 2016 was used.

3. Results

3.1. Personal Data and Reason for GF Diet

Table 1 shows the exact distribution of the answers related the first section. In this study, the ratio of female respondents was high as that of the males.

Further, in this study the reason for GF diet consumption were as follows, 80.8% respondents stated that CD is predominant reason for GF diet intake followed by NCGS (5.2%). Meanwhile, 7.2% respondents stated that its their own decision for GF diet intake without diagnosed medical problem. Their detailed answer revealed they link the GF diet to a healthier life, including consume less of those ingredients (like gluten), which they think 'harmful'.

6.8% signed 'other', meaning one of the followings: wheat allergy, autism, hyperactivity and insulin resistances (IR). For autism GF diet is often recommended, but the effectiveness of the diet is not yet fully proven.

Table 1. Age and gender distribution of the 500 responders (F = female, M = male)

Reason for diet	Age [year]										Sum [%]
	< 18		18-25		26-35		36-45		46 <		
	F	M	F	M	F	M	F	M	F	M	
CD	7.2	5.2	9.2	1.2	17.2	2.8	17.6	3.2	16.4	0.8	80.8
NCGS	0	0	0.8	0	1.2	0.4	1.6	0	0.8	0.4	5.2
Own decision	0.4	0	2	0	2.8	0	2	0	0	0	7.2
Other	0	0	0	0	1.6	0	3.2	0	1.6	0.4	6.8
Sum [%]	7.6	5.2	12	1.2	22.8	3.2	24.4	3.2	18.8	1.6	100

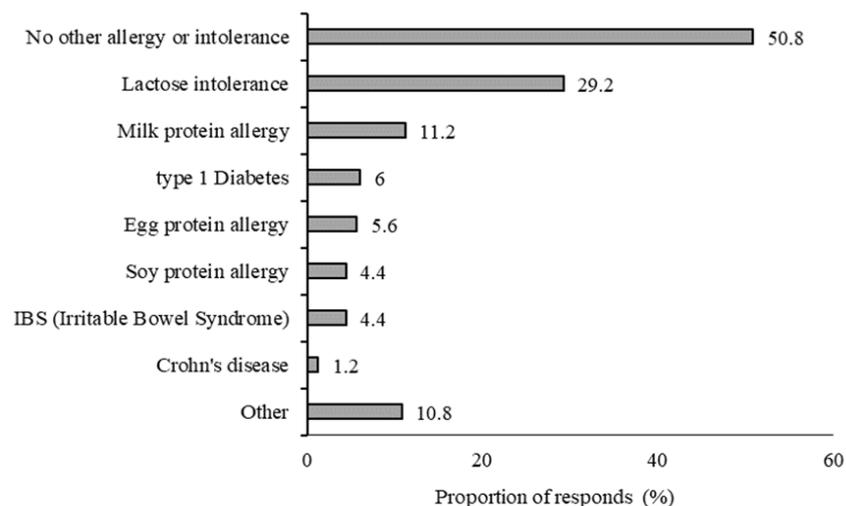


Figure 1. Percentage proportion of responders in terms of having other food consumption related health issue parallel with CD

3.2. Health Status and Duration of GF Diet

In the present study, as the duration of the GF diet increased, the percentage of respondents consuming GF diet also increased (Table 2).

Further, to the question “Do you have other food allergy, intolerance or digestive disorder beside CD” 49.2% of the respondents said yes (Figure 1). In the current study, the most common food related problem is lactose intolerance (29.2%) and milk protein allergy (11.2%). Meanwhile, 48.2% of respondents who were detected with milk protein allergy also elicit lactose intolerance.

Table 2. Duration of the GF diet among the responders

	< 0.5 Year	< 1 Year	1-2 Years	2-5 Years	> 5 Years
Female [%]	7.48	9.35	12.15	22.9	48.13
Male [%]	0	0	22.22	22.22	55.56

Apart from CD, the other conditions like type 1 Diabetes (6%), irritable bowel syndrome (4.4%), egg protein allergy (5.6%) soy protein allergy (4.4%) and Crohn’s disease (1.2%) might be the reason for GF diet consumption among the respondents. Furthermore, in the case of other conditions the respondents reported wheat allergy, Hasimoto’s thyroiditis, Candida and Colitis ulcerosa respectively. Among the 500 respondents, 14.8% reported at least 2 different allergies or intolerance beside CD.

3.3. Bread Consumption Habits

The results of the bread consumption habits among the

respondents in the present study were displayed in Figure 2.

50.4% of the respondents were ‘regular home baker’, and they bake GF bread at least once a week. In this regular home bakers 84.25% were females, with the age range of less than 18 and more than 36 years. On the other hand 29.2% of the respondents were categorized as ‘regular convenient GF bread buyer’, meaning buying at least once a week convenient, pre-baked bread products. In this category, 80.8% were females between the age group of 26-35 years. Meanwhile, the overlap between the regular home baker and regular bread buyer group is 3%. Overall, those who are never buying convenient GF bread fully belong to the regular home baker groups, and the other way around, those who never bake GF bread at home are members of the regular buyer group.

3.4. Satisfaction and Problematic Areas

Figure 3 showed that the majority of the respondents (70.8%) feel that there was a firm, sensible and disturbing difference between the regular wheat based and GF breads. Half of the regular home bakers and 30% of the regular convenient GF bread buyers belong to this group, stated that the dissatisfaction was valid for the home made and the pre-baked convenient products.

Meanwhile, 26.4% of the respondents reported that the differences between the regular and GF breads were not significant and disturbing. In this category, the regular home bakers constitute 50% and 25% were from the regular convenient GF bread buyer. 2.8% responders stated no difference between the regular and GF breads. None of the regular home bakers or regular convenient GF bread buyers belongs to this group, validating the present of dissatisfaction in both product range.

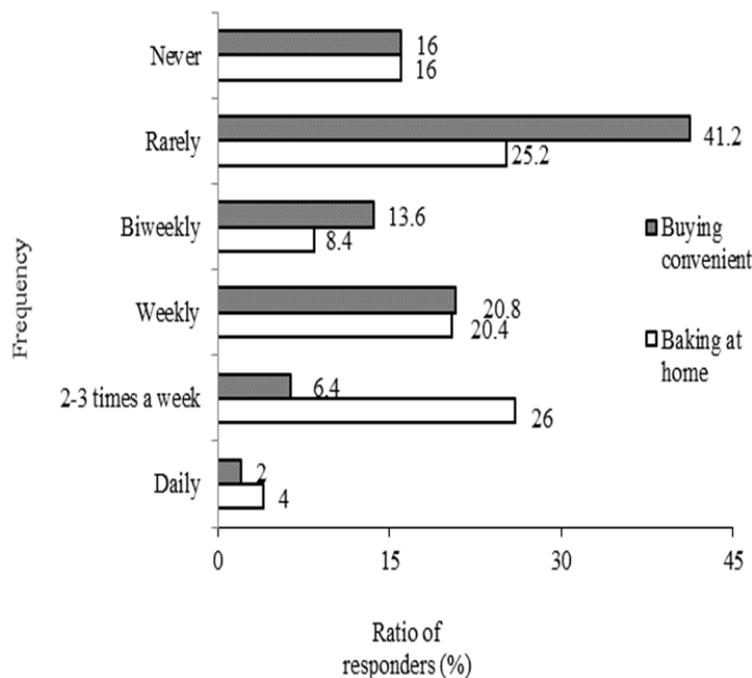


Figure 2. Bread consumption habits, divided by frequency and ‘baking or buying’ characterization

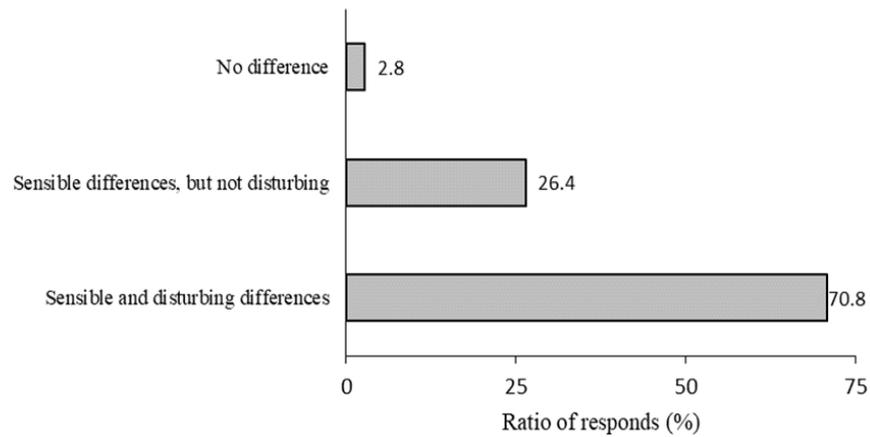


Figure 3. Percentage distribution of responders depending on whether they feel difference between the regular wheat based and the GF breads

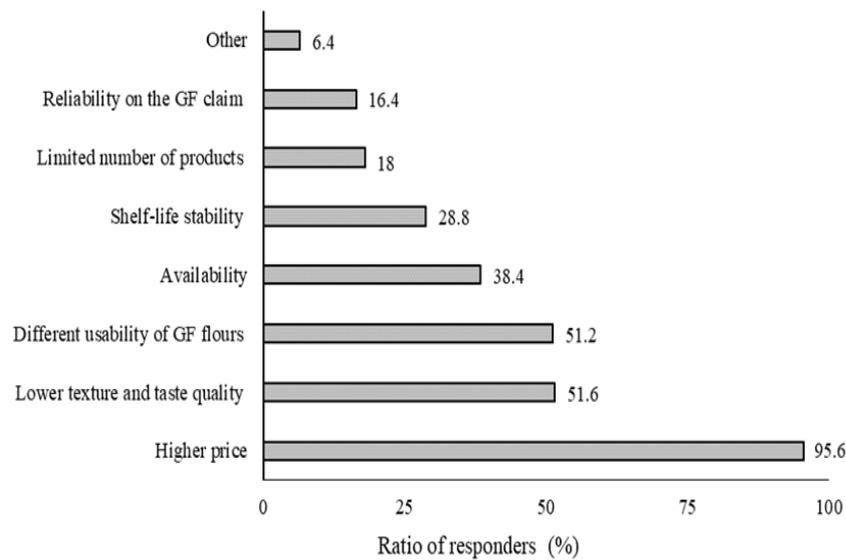


Figure 4. Split on consumer's response regarding the disadvantages of GF breads

Meanwhile, the overall satisfaction was measured on a 10 point scale, where the final average score was 6.2. 6.5% of the respondents scored 'absolute satisfied', while 5% voted for 'absolute dissatisfied', and 34% scored 5 points.

Figure 4 depicted the consumer dissatisfaction and most valid problems were higher price, low texture and taste quality and usage. These responses were given by regular home bakers and GF bread buyers, hence it was so it can be considered as common major problematic areas with top priorities.

Further, when the respondents were asked to set the priority order of the problematic areas, 64.8% mentioned the higher price in the first place, 24.4% set lower texture and taste quality on the second place and 20.8% set the different usability of GF flours on the third place. 28.8% of the responders noted the shelf-life stability of the GF bread as a problem, meaning that they have to consume the GF bread in a short period of time to avoid quality problems. The 6% of other reasons mostly contained the size of the GF flour packs and the revulsion of artificial ingredients like Xanthan gum, hydroxypropyl methylcellulose or preservatives.

3.5. Consumer Trends

The results of the survey depicts that the consumers had at least 2-3 different GF flours at home (52.8%), mainly for baking purposes. Further, 23.6% respondents elicited that it was possible to keep 4-5 GF flours. Meanwhile, 19.6% reported that it was possible to keep more than 5 different GF flours at the same time. However, only 4% the respondents mentioned to keep none or 1 GF flour at home.

4. Discussion

The valid management of CD is lifelong adherence to a gluten-free diet (GFD). Following a GFD necessitate the restriction of the intake of any food products encompassing even trace of gluten containing cereals like wheat, rye, and barley. In this scenario, the present survey based study was conducted to evaluate the consumer's acceptance of available GF breads and flours, consumers' habits and trends, sentience on overall satisfaction, also identifying those areas that are causing daily problems and/or dissatisfaction among the Hungarian population. In

this study the major reason for consuming GFD is due to CD followed by NCGS, which is consistent with study done by [11,20,21]. However, some respondents stated that it's their personal decision to follow the GFD even in the absence of CD. These reports were consistent with other studies conducted by Kim et al and Topper et al. Thus, the outcome of respondents revealed they link the GF with a healthier life, including minimal intake of gluten, which they think harmful to the body.

Furthermore, in our study few respondents highlight that wheat allergy, autism, hyperactivity and insulin resistance were the major reason to follow the GFD. For autism GF diet is often recommended, but the effectiveness of the diet is not yet fully proven [22]. In our study, the female respondents were comparatively higher as that of the males. Similar observation was reported in the study conducted by Silvester et al [31]. The percentage of respondents increases with a substantial increase in the years of GFD intake. However, respondents who follow the GF diet from their own decision keep the diet less than 2 years, reinforcing the fact of the trend's novelty [23,24].

The relation between CD and allergy to milk protein or lactose intolerance have been reported elsewhere which is similar to our study [25,26]. In accordance with Ojetti et al. subjects with CD lead to the progression of secondary hypolactasia due to the destruction of the intestine [27]. However, multiple of patients elicit a restoration of intestinal function and a reduction in the poor absorption of lactose after GFD intake. Further in our study we reported the prevalence of egg and soy allergy, type 1 Diabetes, IBS among the CD patients which is line with the previous reports [28,29].

In our study, majority of the respondents prepare the home made GF breads. Similar observation were seen in a study conducted among the Hungarian CD patients, reveals that 21.8% of the subjects bakes GF bread twice a week and 24.4% one time a week [30]. The reasons for preferring the homemade bread among the respondents were, not satisfied with the quality of the commercially available bread, higher bread price and trust in homemade bread [30]. Our study also shows that, 29.2% are regular convenient GF bread buyer which is line with the study conducted by Risko et al. [30] where the regular GF bread buyers is 51.3%.

In the present study, majority of the respondents revealed that there is dissatisfaction between the regular wheat breads and GF breads. This might be highly attributed due to the fact, that GF breads have liquid dough with problems in macroscopic appearance like texture, color and other baking defects which prelude to low palatability and sensory acceptance [12]. Further, the GF breads are processed with refined flours and raw materials along with artificial flavors [17]. Our report is consistent with the previous study conducted on Hungary CD population and most of the respondents were dissatisfied with the GF breads [30]. Meanwhile, in our study 26.4% of respondents display that regular and GF breads are not significant and disturbing and only 2.8% of respondents are totally dissatisfied in both regular wheat and GF bread. Thus, on a 10 point Likert scale, 6.5 % of respondents are absolute satisfied with GF bread, 5% of respondents are absolute dissatisfied.

In our study, the main problematic area related to dissatisfaction are high price, which is the major concern

followed by low quality and texture and finally array of GF flours used for the bread formulation. This feedback from the responders are in line with the literature data regarding the GF breads, reporting poor, dry and crumbling texture, different shell properties, stronger after taste and overall less preferred taste [12,13,15].

A study conducted by Singh & Whelan reveals that the price of GF breads are significantly higher between 76- 518% as that commercial wheat products [17]. Meanwhile, few respondents elicits that size of the GF flour packs and the inclusion of artificial ingredients like Xanthan gum, hydroxypropyl methylcellulose or preservatives might lead to dissatisfaction [19].

Finally, the high majority of respondents baking GF bread tend to have 2-3 GF flours. The reason for this might be Hungarian consumers are continuously looking for new, better taste and usability, therefore mixing different flours. They are not satisfied with the currently available GF flours by themselves, thus trying to create a better working solution with mixing different GF flours. Furthermore, according to their responses there is no GF flour with universal purpose, which is suitable for baking good quality bread, confectionery products (e.g. cakes, muffin, and pancake), pasta or binding for sauces and soups at the same time. However, with wheat flour it is manageable by itself alone.

5. Conclusion

The results of the study initiates a better and detailed understanding of the Hungarian GF market, also revealing a deeper knowledge on market needs and problems.

One of the issues that approximately half of the people following GF diet have more other food related health problems in Hungary. This reveals that using soy, egg, lactose and/or milk protein as a supplementary solution in GF formulations are not optimal solution from consumer point of view, as these should be avoided for quite a number of GF diet follower. The usage of those supplementary materials also might cause problems for bakery companies, as these proteins are available in dehydrated powder format, which may cause cross-contamination for others products prepared in the same area, increasing the complexity and risk factors.

Substantial information that however this is a proven important area of the Hungarian GF market, consumers are generally not satisfied with the currently available solutions. The most underlying evidence is that 70.8% of consumers are displeased, and the overall satisfaction is 6.2 point out of 10.

Consumers phrased several problematic areas, led by the higher price of GF breads and flours. According to the results, it effects 95.6% of the responders, therefore this is definitely an area, which should be in focus for future product and raw material development studies.

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