

## Gluten-Free Food – the Influence of Selected Qualitative Characteristics on Consumer Decision Making of Coeliacs in Hospitality Establishments

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### Abstract

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The perceptions of individuals with coeliac disease about gluten-free products and their consumer behaviour when eating out in hospitality establishments in the Czech Republic were investigated. The dependence of the selected characters important in the consumer behaviour of coeliac patients in the decision-making process when choosing a dining establishment, in particular the focus on identifying the key criteria that influence the decision-making of coeliac patients when selecting a particular public catering establishment, were examined. 441 questionnaires were analysed. The result is a finding of the consistency and relevance of characters in the decision-making process of coeliacs when selecting dining establishments and their satisfaction with the range of gluten-free foods in open and closed dining establishments in the Czech Republic. Deglutenised foods (raw ingredients) are very expensive and a structured and economically balanced range of processed products should be found in the hospitality industry with the acceptance of the purchasing power of their consumers.

**Keywords:** coeliac disease; consumer behaviour; food consumption; purchase

Gluten is usually understood as the fraction of hydrated prolamin (gliadin) and glutelin wheat proteins which are located together with starch in the endosperm of some seeds of cereals, in particular wheat, rye, and barley.

Coeliac disease (gluten intolerance) is a lifelong autoimmune disease. It is chronic inflammation of the mucosa of the small intestine and disappearance (atrophy) of intestinal villi, through which nutrients are absorbed into the blood during the process of digestion. The disease is caused by fractions of hydrated prolamin (gliadin) and glutelin wheat proteins or glutelin fractions of barley (hordein) and rye (secalins) proteins. “In addition to the gastrointestinal system, coeliac disease can also involve other body systems and cause conditions including short stature, osteoporosis, and iron-deficiency anaemia” (MORENO 2014). The causes of the disease may be

different, for example the connection between coeliac disease and rachitis (rickets) in children (SAEED 2013). The disease can occur in childhood but also in adulthood (ARENDE & DAL BELLO 2011). Individuals who produce larger quantities of antibodies against enzymes and proteins that are part of gluten are compromised by this autoimmune disease (KLENER 2012). Epidemiological studies carried out during the last decade have revealed the fact that coeliac disease is one of the world’s most common life-long diseases (FASANO & TRONCONI 2008).

Currently, it is possible to see an increase in the number of people – consumers who have problems when eating foods containing gluten (according to the data of the State Agricultural and Food Inspection Authority the prevalence of coeliac disease is indicated as 1 : 100 to 1 : 200). According to the independent non-profit organisation AO ECS (2014)

founded in 1988, which covers coeliac associations from 31 European countries with 37 member organisations in Europe, there are currently about 5 million coeliacs, of which over 250 000 have been diagnosed (<http://www.celiak.cz/o-nas/aoecs>). “The new epidemiology of coeliac disease is now characterised by an increase in new cases in the historical coeliac disease areas (northern Europe and the United States) and more interestingly by a spread of the disease in new regions (Asian countries). A significant change in diet habits, particularly in gluten consumption as well as in infant feeding patterns are probably the main factors that can account for these new trends in coeliac disease epidemiology” (CATASSI *et al.* 2014). Coeliac disease is considered to be a partly hereditary disease that affects nearly 1 in 100 people, while 97% of patients have not been diagnosed and treated (JONES & GREEN 2010).

The main dietary sources of gluten are cereals and all products made from them. Also prohibited are all products made from barley, oat and rye. For coeliac patients, it is even dangerous to consume foods that might be contaminated with gluten. Another related problem is the contamination of wheat starch with cereal protein residues. Wheat starch is the main product that contains gluten. You cannot use even so-called “pure” or “modified” wheat starch (it contains prolamins).

In the Czech Republic, only very few public catering establishments can be found where meals are prepared according to the rules of a gluten-free diet. MCINTOSH *et al.* (2011) showed that even though the restaurants claim to offer gluten-free, for the coeliac consumer it is not a guarantee that the food will be prepared in accordance with the principles of gluten-free diet. Generally it can be said that eating out at a restaurant can often pose a significant health risk (BRYAN 2012).

The aim of this study was to examine the dependence of the selected characteristics important in the consumer behaviour of coeliac patients in the decision-making process when choosing a public catering establishment.

## MATERIAL AND METHODS

Consumer preferences of the specific group of customers with a gluten-free diet in relation to the examination of selected factors that are the main determinants of their demand and decision-making when purchasing dietary services were determined through

carrying out comprehensive comparative research with a combination of quantitative and qualitative research using in-depth individual interviews. The data was collected from February 2013 to June 2014.

The result of a questionnaire survey is categorical data (sometimes qualitative attributes) that is not directly measurable and is therefore expressed in verbal form. The basic overview of the detected values of certain variables provides a distribution of the frequency of individual categories using simple tables and graphs. However, the analysis of qualitative characteristics most often focuses on assessing the relationship between two characteristics, with the help of so-called contingency tables. They are two-dimensional tables that are created by sorting according to two variables A and B. Variable A has  $r$  categories (levels) and variable B has  $s$  categories (levels). Frequency  $n_{ij}$  represents the number of elements in the selection of size  $n$ , which according to variable A belongs to category  $A_i$  and according to variable B it belongs to category  $B_j$ . Furthermore,  $n_i$  defines the number of elements of the sample which belongs to category  $A_i$  irrespective of the value of variable B and similarly  $n_j$  number of elements belongs to category  $B_j$  irrespective of the value of variable A (this is called marginal frequency) (HINDLS *et al.* 2007).

The analysis of contingency tables is based on the test of independence (whether there is a correlation between characters) and on determining the closeness of the dependence. The test, which is used to verify independence, compares the compliance of observed and expected frequencies (HINDLS 2007). The null hypothesis assumes that both characters are independent of each other. To assess the validity of this hypothesis the  $\chi^2$  goodness of fit test is used, where a variable is chosen as the test criterion:

$$\chi^2 = \sum_{i=1}^r \sum_{j=1}^s \frac{n \times n_j^2}{n \times n_j} - n \quad (1)$$

This random variable assumes the null hypothesis for the  $\chi^2$ -distribution of degrees of freedom  $[(R - 1) \times (S - 1)]$ . If the value of the test criterion  $\chi^2$  exceeds the critical value, which is the quantile  $\chi_a^2$  with degrees of freedom  $[(R - 1) \times (S - 1)]$ , then the chosen significance level is the rejected  $\alpha$  hypothesis of independence between the observed qualitative characteristics and dependence is thus considered to be established (PEČÁKOVÁ 2008).

Evaluation of the strength of dependence is performed similarly to the correlation characteristics in

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the case of the dependence of quantitative characters. Values close to 0 indicate a weak dependence (up to approximately 0.3). The medium dependence is mentioned if the corresponding rate acquires a value ranging from 0.3 to 0.7. Cases where the given rate exceeds the value 0.7 will be marked as strong (sometimes high).

To measure the intensity of interdependence, the coefficient of mean square contingency  $C$  (Pearson contingency coefficient) is used, which is calculated as follows (PEARSON 1900):

$$C = \sqrt{\chi^2 / (n + \chi^2)} \quad (2)$$

If the examined characteristics are independent, the value of this coefficient is zero. However, the maximum value achieved in complete dependence is lower than 1 and varies depending on how many classes the examined characteristics were divided into.

The strength of dependence can also be measured using the phi coefficient as follows (ŘEZANKOVÁ 2007):

$$\Phi = \sqrt{\chi^2 / n} \quad (3)$$

Another contingency coefficient is Cramér's  $V$ , calculated according to Eq. (4) (ŘEZANKOVÁ 2007):

$$V = \sqrt{\chi^2 / [n (h - 1)]} \quad (4)$$

where:  $h$  – min. (r, s); thus the maximum value in the denominator is what Pearson statistics can reach  $\chi^2$

The SAS 9.4 statistical programme was used for the statistical processing of correlations of qualitative characteristics.

## RESULTS AND DISCUSSION

Dependence between gender and frequency when searching for a gluten-free diet in dining establishments in the hospitality industry is shown in Table 1.

Eating in restaurant facilities is not a part of the normal eating habits of coeliac patients (Table 1). The vast majority of them (49%) uses the services of public catering only rarely – less than once a week. Every day or around every other day, 26% of people with a gluten-free diet seek a hospitality establishment and 24% of respondents eat out in a hospitality establishment one per week. In the case of the relationship between gender and the frequency of eating out in hospitality establishments, no statistically significant correlation has been demonstrated. As shown by the result of  $\chi^2$ -test, men and women

do not look very much for the opportunity to eat in the public catering. The null hypothesis about the dependences between gender and the frequency of eating is not rejected in this case.

A statistically significant relationship was demonstrated between the age of consumers – coeliacs and the frequency of eating out at hospitality establishments, because the value  $P = 0.0074$  is lower in this case than the significance level  $\alpha = 0.05$ . In terms of the strength of dependence, it is a weak dependence (contingency coefficient 0.24). This means that in connection with the existence of economic activity of the given person the age is directly related to the intensity of the use of services of restaurant establishments. Persons aged 20–40 years, i.e. people of working age (74.6%), clearly eat out at restaurants most frequently. Persons younger (under 20 years) and persons older than 60 years of age eat mainly in a different way.

A visit to a particular type of hospitality establishment depends on various criteria. In this case the null hypothesis assumes that the critical factors for eating out at a hospitality establishment are not e.g. freshness and quality of food, assortment of dishes, etc. Findings of the  $\chi^2$ -test show that it is possible to reject the null hypothesis. Thus, the main decisive factors for consumers to use the services of a dining establishment are primarily according to the above-mentioned criteria. The strength of dependence

Table 1. Dependence between gender and frequency when searching for a gluten-free diet in dining establishments in the hospitality industry

Expected frequency	Male	Female	Total
Less than once per week	55 61.508	162 155.49	217
One per week	28 30.896	81 78.104	109
Every day	22 16.44	36 41.56	58
Every other day	20 16.156	37 40.844	57
Total	125	316	441
Statistic	DF	Value	Prob
$\chi^2$	3	5.2401	0.1550
Likelihood ratio $\chi^2$	3	5.0701	0.1667
Mantel-Haenszel $\chi^2$	1	3.8465	0.0498
Phi coefficient		0.1090	
Contingency coefficient		0.1084	
Cramér's $V$		0.1090	

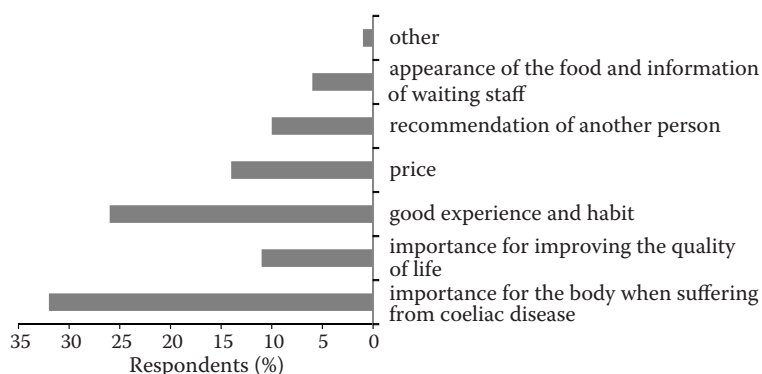


Figure 1. Decisive criteria when purchasing a particular food for a gluten-free diet

is relatively high when judged by the contingency coefficient (0.72). However, because this coefficient is influenced by the contingency table that has been created, it is preferable to assess the intensity of dependence using Cramér's  $V$ , which does not take into account the size of the table rated.

In the case of monitoring the impact of selected criteria (significance for the body in coeliac disease, importance of improving the quality of life for coeliac patients, good experience and habit, recommendations of others, appearance of gluten-free food and information of the waiting staff) that are decisive when buying specific gluten-free meals in terms of the type of hospitality establishment, a dependence was demonstrated statistically, which was rated as moderate (Cramér's  $V = 0.4649$ ). Individuals who when making a purchase prioritise the health aspects of their disease, good experience with the given dining establishment and the importance for improving the quality of life, prefer the restaurant type of hospitality establishment with the waiting staff to other types of establishments (Figure 1).

Based on the values of  $P = 0.2124$ , which is greater than the significance level  $\alpha = 0.05$ , the null hypothesis is not rejected in this case. Thus the influence of the above criteria on the perception of prices was not demonstrated (Table 2).

Table 2. Influence of selected criteria on the perception of gluten-free food prices with regard to the total expenditure on food for coeliac

Statistic	DF	Value	Prob
$\chi^2$	49	56.6019	0.2124
Likelihood ratio $\chi^2$	49	58.1456	0.1740
Mantel-Haenszel $\chi^2$	1	0.0106	0.9181
Phi coefficient		0.3583	
Contingency coefficient		0.3373	
Cramér's $V$		0.3583	

In the case of dependence between the frequency of searching for a gluten-free diet at hospitality establishments in the Czech Republic and the significance of discounts or special offers when buying gluten-free foods, it was assumed that the frequency of visits to establishments will not be affected by special price offers (the null hypothesis states that these characteristics are independent). Based on the conducted test, it can be stated that the null hypothesis is rejected and dependence between the characteristics is demonstrable, i.e. discounts or promotions are quite important for coeliacs. The intensity of this dependence can be marked as weak (Cramér's  $V = 0.1313$ ) and contingency coefficient  $C = 0.2217$ .

The impact of discounts and special offers when buying gluten-free meals on the selection of the type of hospitality establishment for coeliacs was  $\chi^2$  – con-

Table 3. The influence of perception of price of gluten-free foods on the frequency of eating out at hospitality establishments when required to keep a gluten-free diet

Expected frequency	High	Reasonable	Total
Less than once per week	168 173.7	49 43.302	217
One per week	88 87.249	21 21.751	109
Every day	52 46.426	6 11.574	58
Every other day	45 45.626	12 11.374	57
Total	353	88	441
Statistic	DF	Value	Prob
$\chi^2$	3	4.3656	0.2246
Likelihood ratio $\chi^2$	3	4.8907	0.1800
Mantel-Haenszel $\chi^2$	1	1.2584	0.2620
Phi coefficient		0.0995	
Contingency coefficient		0.0990	
Cramér's $V$		0.0995	

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firmed by the test ( $P = 0.0003 < \alpha = 0.05$ ). The strength of the dependence can be evaluated as weak (Cramér's  $V = 0.2480$ ) to moderate (contingency coefficient  $C = 0.3947$ ). Discounts are of great importance for 28% of coeliac patients, or only partially important for half of them. Thus discounts and special offers are among the important criteria in selecting a particular hospitality establishment for almost 80% of individuals in this specific group of customers. From the perspective of restaurant operators, it can be said that special offers can arouse interest in a large group of customers while also attracting new customers.

In this case, the hypothesis is verified that the frequency of eating out at dining establishments is not related to the perception of the price of gluten-free foods. Based on the value of  $P = 0.2246$ , which is greater than the selected level of significance  $\alpha = 0.05$ , the specified null hypothesis cannot be rejected. This suggests that the price of gluten-free foods does not have a major impact on the frequency of eating out at dining (Table 3).

## CONCLUSION

Consumers, who have a problem with the consumption of foods containing gluten, represent an increasingly important customer segment for manufacturers and distributors with gluten-free food. An integral part of their quality of life, however, is the possibility to choose gluten-free foods, and especially also gluten-free meals included on the menu of restaurant facilities. Coeliacs can motivate restaurant operators to specialisations in the menu of gluten-free and dietary meals. To achieve this, it is necessary to proceed with social responsibility towards the aforementioned population group by creating the same conditions in the quality of life within the scope of their food as for others.

## References

- AOECS (2014): Available at <http://www.celiak.cz/o-nas/aoecs> (accessed Jan 06, 2014).
- Arendt E.K., Dal Bello F. (eds) (2011): *Gluten-Free Cereal Products and Beverages*. London, Academic Press.
- Bryan A. (2012): *The Gluten Free Guide to Fast Food Restaurants*. Diamondhead Studio LLC.
- Catassi C., Gatti S., Fasano A. (2014): The new epidemiology of celiac disease. *Journal of Pediatric Gastroenterology and Nutrition*, 59: S7–S9.
- Fasano A., Tronconi E. (2008): *Frontiers in celiac disease*. In: Braňsk D. (ed.): *Pediatric and Adolescent Medicine*. 1. Basel, Karger AG.
- Hindls R., Hronová S., Seger J. (2007): *Statistika pro ekonomii*. 8<sup>th</sup> Ed. Prague, Professional Publishing.
- Jones R., Green P. (2010): *Celiac Disease: A Hidden Epidemic*. New York, Harper Collins.
- Klener P. a kol. (2006): *Vnitřní lékařství*. Prague, Galen and Karolinum.
- McIntosh J., Flanagan A., Madden N., Mulcahy M., Dargan L., Walker M., Burns D.T. (2011): Awareness of coeliac disease and the gluten status of 'gluten-free' food obtained on request in catering outlets in Ireland. *International Journal of Food Science and Technology*, 46: 1569–1574.
- Moreno M. (2014): Celiac disease in children and adolescents. *JAMA Pediatrics*, 168: 295.
- Pearson K. (1900): On the criterion that a given system of deviations from the probable in the case of a correlated system of variables is such that it can be reasonably supposed to have arisen from random sampling. *Philosophical Magazine Series 5*, 50 (302): 157–175.
- Pecáková I. (2008): *Statistika v terénních průzkumech*. Prague, Professional Publishing.
- Řezanková H. (2007): *Analýza dat z dotazníkových šetření*. Prague, Professional Publishing.
- Saeed A. (2013): Celiac disease presenting as rickets in Saudi children. *Annals of Saudi Medicine*, 33: 49–51.

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