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# Examining Non-Celiac Consumers of Gluten-Free Products: An Empirical Evidence in Spain

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Additional information is available at the end of the chapter

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## Abstract

This chapter investigates the personal factors that influence intention to purchase gluten-free products (GFPs) in Spain by non-celiac consumers. To achieve this objective, a survey was conducted with 222 consumers in a medium-sized Spanish town, Zaragoza, during March–April 2014 and, ordered bivariate probit model was estimated. The results suggest that intention to purchase is affected not only by self-reported GFP knowledge but also by attitudes toward GFPs, gender, and education level.

**Keywords:** gluten-free, non-celiac consumers, intention to purchase, bivariate probit

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## 1. Introduction

Celiac disease (CD) is an autoimmune pathology associated with a permanent intolerance to a protein called gluten to which the immune system responds abnormally, generating damage in the small intestine. Although CD cannot be cured, the main treatment for this pathology is to follow a diet without all cereal grains and their derivatives in order to prevent damage to the intestine [1, 2]. In the past decade, the gluten-free (GF) demand trend has dramatically increased even if people with CD represent only 1–2% worldwide [3]. One of the major reasons for the increase in the popularity of gluten-free products (GFPs) is obesity epidemic that has encouraged also people who do not suffer from CD to adopt different eating habits and to show some interest in GFPs. Several beliefs and facts related to food intolerance have emerged, for example, that gluten may increase the risk of attention deficit hyperactivity disorder (ADHD), irritable bowel syndrome (IBS), and autism [4]. Even though there is no scientific consensus about the existence of relation between gluten and these diseases, many non-celiac consumers are choosing a GF diet to preserve their health. This fact is also confirmed by a study carried out by packaged facts [5], which revealed that the main reasons why consumers

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intentionally purchased gluten-free products are because they considered GFP healthier, helpful for weight loss, and higher quality. Hence, trends in the GF market has been increasing around 28% since 2008 suggesting that the supply of GFPs could satisfy the demand not only of celiac individuals but also of people without CD who decide to preserve their health status by excluding gluten from their diets [6]. Hence, understanding of the predictors of purchase behavior of non-celiacs people is critical in light of potential consequences associated with elimination foods containing gluten from their diet when there is no medical necessity. Indeed, several people believe that a GF diet may result in a diet that is high in fat and low in carbohydrates and fiber, as well deficiencies in proteins, minerals, and vitamin B-12 [7, 8].

Empirical evidence on non-celiac behavior toward GFP is still scarce. To our knowledge, there are just three other investigations on GF consumers examined non-celiac consumers' preferences for some GF attributes. To illustrate, Laureati et al. [9] compared the sensory and hedonic perceptions between celiac and non-celiac people. The authors found that there was no difference between the two groups in the description and perception of GF bread, and that the choice of bread was based upon the softness and porosity of GF bread. Likewise, de-Magistris et al. [10] explored the effects of organoleptic attributes on preferences expressed in terms of willingness to pay (WTP) for GF snack assessed by non-celiac consumers in Spain. The results indicated that the texture of the GF snack was the only significant and positive attribute on consumers WTP values. Finally, de-Magistris et al. [11] reported that taste and GF label use did not influence the non-celiac consumers' WTP values.

Nevertheless, since there remain significant gaps concerning the analysis of determinants affecting the intention to purchase of GFPs by non-celiac consumers, our study aims to fill this gap in the literature. Therefore, the aim of this study is to analyze the intention to purchase GFPs in Spain by non-celiac consumers. To assess the determinants of intention to purchase, an ordered bivariate probit model is specified and estimated by using data for a survey conducted in Spain in 2014. To the best of our knowledge, this is the first study to investigate the intention to buy GFPs by non-celiac people in Spain. This chapter is structured as the following. Section 2 describes the legislation on gluten-free products while Sections 3 and 4 explain the Spanish Federation of Celiac Association (FACE association) and gluten-free label, respectively. Then, Section 5 describes the methods to conduct the investigation while Sections 6 and 7 discuss the results and conclusions.

## **2. Legislation on “gluten-free” food**

The levels of gluten in the gluten-free products can vary greatly, misleading the consumer and potentially impacting on their health. Defined labeling terms will act, as protection measures, which will ensure that all food labeled, are suitable for people intolerant to gluten. In addition, consistent labeling will help consumers to better understand how much gluten there might be in the foods they buy and help them manage their risk of exposure to gluten [6].

Stemming from a joint Food Agriculture Organization of United Nations (FAO) and World Health Organization (WHO) Food Standards Program, the Codex Alimentarius Commission

procedure manual is giving guidance to government's member for food legislation and industry, especially when participating in global trade. In the revised Codex Alimentarius publication about standard for foods for special dietary use for persons intolerant to gluten [12], gluten-free food is a dietary food naturally containing no wheat prolamins and/or consisting from wheat which have been specially processed to remove gluten; however, the gluten level should not exceed 20 mg/kg in total. Codex standards also recognizes another category of food namely "Foods specially processed to reduce gluten content to a level between 20 and 100 mg/kg" that is consisting of one or more ingredients from wheat, which have been specially processed to reduce the gluten content to a level above 20 up to 100 mg/kg in total.

Likewise, in the European Union, the rules concerning the composition and labeling of food intended for people suffering from an intolerance to gluten are common, the terms gluten-free and very low gluten are covered by the Commission Regulation (EC) No. 41/2009 for the labeling of gluten-free foods [13], that set levels of gluten for all categories of foods, non-pre-packed, pre-packed, or sold loose, in health food stores or in catering establishments, claiming to be either "gluten-free" or "very low gluten", which came into force in January 2012. These levels are:

- "Gluten-free": at 20 parts per million of gluten or less.
- "Very low gluten": at 100 parts per million of gluten or less; however, only foods with cereal ingredients that have been specially processed to remove the gluten may make a "very low gluten" claim.

Further, the Regulation (EC) No. 1169/2011 established the mandatory labeling for all foods of ingredients such as gluten containing ingredients [14], with clarity and more consistency, and that is by:

- a minimum font size of information to make labeling clearer,
- indicating allergens in the ingredients list, and
- emphasizing allergen information for non-pre-packed food, including in restaurants and cafes.

For this reason, later the Regulation (EC) No. 609/2013 amend the Regulation (EC) No. 1169/2011 on the provision of food information to consumers as regards information on the absence or reduced presence of gluten in food [15].

Ultimately, the new Regulation (EC) No. 828/2014 clarifies how operators can inform consumers of the difference between foods that are naturally free of gluten and products that are specially formulated [16].

### **3. Spanish Federation of Celiac Associations (FACE)**

As the Association of European Celiac Societies (AOECS) cover 35 members from 29 European countries to increase the awareness of celiac disease, to facilitate the accessibility of information

and the availability of gluten-free products. In Spain, the Spanish Federation of Celiac Associations (FACE) was legally established on June 27, 1994 as a non-profit organization, its main aim is to ensure the well-being and quality of life of those suffering from celiac disease. This federation groups together with 16 Celiac Associations from the autonomous regions of Andalusia, Aragón, Asturias, the Balearic Islands, the Basque Country, the Canary Islands, Cantabria, Castile-La Mancha, Castile-León, Community of Valencia, Extremadura, Galicia, La Rioja, Melilla, Murcia, and Navarre. In each region of Spain, there is an official association for celiac people. All of them, except the Celiac Association of Madrid (ACM) and the Celiac Association of Cataluña (SMAP), are part of the FACE.

Furthermore, it coordinates and supports the efforts undertaken by the member associations/federations in defense of their rights, with an emphasis on unity of action leading to great success in achieving joint aims. It also takes into account safety regulations, manufacturing processes, and an evaluation of the ingredients listing for products sold in Spain to publish listing of gluten-free products that are “Safe for Celiac” by manufacturer and a FACEMOVIL application that offers assistance to celiac.

Its affiliate in Aragon, the Celiac Aragonese Association (ACA), is a non-profit organization that provides information about the celiac illness and the gluten-free diet. It also provides information about restaurants, hotels, and other establishments that collaborate with them.

#### 4. The quality label

In addition to the general labeling provisions reclaim in the General Standard for the Labeling of Prepackaged Foods [17] and the General Standard for the Labeling of and Claims for Prepackaged Foods for Special Dietary Uses [18], and any specific labeling provisions set out in a Codex standard applying to the particular food concerned, the Association of European Celiac Societies (AOECS) has created a licensing system (**Figure 1**) for the use of the crossed grain symbol, which is the international emblem for the gluten-free products. Only the companies and organizations meeting their criteria can use it [19].

The AOECS has also established a:

- Registration no.
- Gluten content.
- Oats content. A product containing oats as an ingredient or pure oats, shall be labeled “gluten-free” and may use the symbol as long as the word “OATS” is displayed under it.
- And gluten-free Standard based on a Hazard Analysis and Critical Control Point System (HACCP) for producers and food safety inspectors to avoid contamination with gluten at any stage during the manufacturing, packaging, and storing processes.

Even more, the Spanish Federation of Celiac Associations has settled a quality label “Controlado por FACE” to assure to the celiac consumers that any products carrying it is complying with the requirements proposed by FACE concerning maximum content in gluten, making them safe for their consumption (**Figure 2**).



Figure 1. The crossed grain symbol (by AO ECS).



Figure 2. The quality label "Controlado por FACE" (by FACE).

Any enterprise which produces gluten-free products may use the quality label. However, this label can be used also by those companies that produce foodstuffs that can be consumed by celiac when the absence of gluten in the food product is guaranteed.

Furthermore, the quality label also requires control over suppliers of raw materials to avoid the risk of gluten contamination, by means of which a more efficient control is exercised over food products aimed at celiac.

Even though, it may exist in the market some legends and symbols of “gluten” or “gluten free” that are usually used by private brands and do not have official character.

## 5. Materials and methods

### 5.1. Data gathering and questionnaire

As mentioned previously, the aim of the study is to investigate the intention to purchase GFPs by non-celiac consumers in Spain. Therefore, a survey was conducted in Spain from March to April 2014. The sample size of the research consisted 222 subjects randomly chosen across the city. The population was considered infinite since Zaragoza has more than 70,000 citizens. Zaragoza was chosen because it is a town widely used by food marketers and consulting companies since the socio-demographic profile of people living in this town is representative of the entire Spanish population.

The error was calculated to the following equation (1) taking into account the proportional data and the population of Zaragoza:

$$N = 4 * p * q / \varepsilon^2 = 222 \text{ Surveys} \quad (1)$$

where  $N$  is the total sample size,  $P = 0.5$  for a maximum sample size,  $Q = 1 - p$ ,  $\varepsilon$  is the error term which was set at 6.71% for an inferential error 0.995.

The technique chosen for framing the sample was probabilistic proportional sampling.

### 5.2. The questionnaire and variables definitions

Consumers were asked to complete a questionnaire concerning questions on consumer purchase behavior for GFPs (**Table 1**). The questionnaire was divided in several parts. The first section analyzed knowledge toward GF. An opening question evaluated the self-reported knowledge of the participants. As showed in **Table 1**, the level of GFPs knowledge (KNOW) was measured by asking respondents their self-reported level of knowledge from 1 to 3, where 3 indicates the highest level of knowledge.

The second part of the questionnaire focused on health status and purchase habits. The first question was to ask the respondents if they suffered from any disease or intolerance related with gluten (SUFFER). This variable was measured on a 5-point Likert scale with 5 meaning strongly disagree. The second question was if non-celiac individuals used to taste new food and beverages (NEW) and it was measured on a 5-point Likert scale with 5 meaning strongly disagree. Then, another question was to determine if consumers ate sweet snacks when they were sad (SWEET), measured by a 5-point Likert scale with 5 meaning strongly disagree.

The last question in the questionnaire was the importance of the gluten-free label by asking the participant whether they seek or not for this type of labeling on the products they purchase (LABEL). The question was coded as dummy variables meaning 1 if individuals seeked for GF labeling when shopping, 0 otherwise.

Name (Type)	Variable definition	Sample
<i>Endogenous variables</i>		
INTENTION	Intention to purchase GFP Yes (5) Probably yes (4) Indifferent (3) Probably no (2) No (1)	12.6% 20.7% 32.4% 19.8% 14.4%
KNOWLEDGE	Consumer's GFP knowledge High (3) Medium (2) Low (1)	5% 34% 61%
<i>Exogenous variables</i>		
FEMALE (dummy)	Gender Male Female	49% 51%
AGE	Age of respondent (average)	47.8
UNIVERSITY (dummy)	Education of respondent Elementary School High School University	27% 43% 30%
INCOME	Average household monthly net income Between 900 and 1500 Euros Between 1501 and 3500 Euros More than 3500 Euros	46.8% 39.2% 14.0%
<i>Attitudes toward healthfulness of GFPs and its taste</i>		
HEALTH (Likert scale)	I believe that GFP are healthier than conventional ones	2.82
EFFECTS (Likert scale)	I believe that GFP have secondary effects	3.28
CHEAP (Likert scale)	I believe that GFP are expensive	3.54
<i>Health status and lifestyles (dummy or average)</i>		
LABEL (dummy)	I usually pay attention to GF label before buying some products	21%
DESEASE (Likert scale)	I have some disease linked to intolerance	4.7
NEW (Likert scale)	I usually like to taste new food and beverages	3.8
SWEET (Likert scale)	When I am sad I usually eat sweet snack	3.1

**Table 1.** Sample characteristics (% , unless stated) and definition of the variables [21].

In the third part of the questionnaire, the attitudes toward GFP were evaluated. In particular, individuals were asked if they believed that GFP were healthier than conventional ones (HEALTH), that GFPs had secondary effects (EFFECTS), and they were expensive (CHEAP).

The fourth section of questionnaire consisted of the intention to purchase GFPs measured by asking respondents whether they intended to buy these products (GFP) if they were available at the place they usually do their purchases. This variable was measured on a scale from 1 (definitely no) to 5 (definitely yes). The last part of the questionnaire provided information on demographic characteristics of the respondents. They were asked to indicate their year of birth, gender, number of household members, monthly incomes, level of studies (Primary, Secondary, and University), and neighborhood.



### 5.3. Model specification

In the model of intention to purchase gluten-free products, we consider two discrete variables: knowledge (KNOW) and intention to buy (INTENTION), as showed in **Table 1**. Since it is likely that the intention to purchase GFP and the knowledge toward them are correlated, a bivariate ordered probit model is specified to take into account for the possible correlation of error terms between the equations.

Eq. (2) in our model is the level of knowledge on GFPs ( $K$ ) specified as:

$$K_i^* = \omega y_i + \xi_i \quad (2)$$

where  $y_i$  represents all the exogenous variables such as personal and socio-demographic characteristics attitudes toward healthfulness of GFPs and its taste and, the importance attached to GF labels for each “ $i$ ” respondent and  $\xi_i$  is the normally distributed error term  $N(0, \sigma_\xi^2)$ .  $K_i^*$  is the unobserved knowledge about GFPs but the knowledge ( $K$ ) stated by the respondents ( $K$ ) is observed and has been measured by three levels (**Table 1**) as follows:

$$K_i = 1 \text{ if } K_i^* \leq \psi_1 \quad (3)$$

$$K_i = 2 \text{ if } \psi_1 \leq K_i^* \leq \psi_2 \quad (4)$$

$$K_i = 3 \text{ if } \psi_2 \leq K_i^* \quad (5)$$

The second question in the model is consumers’ intention to purchase gluten-free products ( $IP$ ), specified as follows:

$$IP_i^* = \lambda K_i^* + \beta x_i + u_i \quad (6)$$

where  $K_i^*$  is the consumer's GF knowledge defined above;  $x_i$  contains all exogenous variables such as socio-demographic characteristics, attitudes toward healthfulness of GFPs, and its taste and lifestyles and eating habits, and,  $u_i$  is the error term normally distributed  $N(0, \sigma_u^2)$ .  $IP_i^*$  is an unobserved variable but the stated intention to purchase ( $IP$ ) was measured by five levels, as follows:

$$IP_i = 1 \text{ if } IP_i^* \leq \tau_1 \quad (7)$$

$$IP_i = 2 \text{ if } \tau_1 \leq IP_i^* \leq \tau_2 \quad (8)$$

$$IP_i = 3 \text{ if } \tau_2 \leq IP_i^* \leq \tau_3 \quad (9)$$

$$IP_i = 4 \text{ if } \tau_3 \leq IP_i^* \leq \tau_4 \quad (10)$$

$$IP_i = 5 \text{ if } \tau_4 \leq IP_i^* \quad (11)$$

As mentioned before, to estimate the two Eqs. (2) and (6), we assumed that the error terms ( $u_i$  and  $\xi_i$ ) may be correlated and follow a normal distribution  $N(0, \Sigma)$  and the bivariate ordered probit has been estimated using the STATA 11 statistical software package (see Sajaia [20], for an explanation of the estimation procedure).

## 6. Results

Summary statistics showing the characteristics of the sample and the population are presented in **Table 1**. About 49.1% of the samples were male while 50.9% were female. The group age “more than 60” represented the majority of the sample with the 28.4% and the group age “18–30” represented the minority of the sample with the 21.6%. In addition, the table indicates that the percentage of subjects living alone or in pairs was 43.7% and the percentage of subjects living in small or medium families, three to four members, was 41.9%. With regard the household monthly incomes, the sample was considered to have low and average household incomes, 46.8% of the subjects stated incomes up to 1500€, 49.2% between 1500 and 3500€, and only 14% above 3500€. Finally, around 27% of the participants had primary education level, 39.2% secondary education level, and 33.8% university level.

The estimated parameters for the model defined by Eqs. (2) and (8), using the variables defined in **Table 1**, are presented in **Table 2**. First, we estimated the model with all explanatory variables reported in **Table 1**. Those variables individually and/or jointly insignificant were dropped one by one in the subsequent estimations until we got the final model presented in **Table 2**.

Coefficients	Knowledge		Intention to purchase		
	Estimates	t-ratio	Estimates	z-ratio	
Female	-	-	0.220	1.65	*
University	-	-	-0.351	-2.27	
Desease	0.351	1.78			*
Label	1.066	5.31			***
New	0.141	1.80			*
Health	-	-	0.169	2.07	**
Effects	-	-	0.130	1.92	**
Cheap	-	-	-0.151	-2.43	***
Sweet	-	-	1.37	2.18	***
Know	-	-	0.53	4.11	***
N					
Wald test $\chi^2$ (3)	34.30				
Prob > $\chi^2 = 0$	0.000				
Log Likelihood=	-430.922				
$\rho$ = (z-ratio = **)	-0.601	-2.87			**

\*\*\* denotes statistical significance at the 5 and 10% significance levels.

**Table 2.** Estimates of the bivariate ordered probit model.

In the estimations, we considered only those exogenous variables statistically different from zero at the 5% significant level. First, the  $p$  value was statistically significant at 5% suggesting that errors for the two equations are indeed correlated. Therefore, we can conclude that the simultaneous estimation of both equations is the appropriate approach to obtain consistent parameter estimates since equations are not independent of each other.

Only three variables have been found statistically significant at 5% level in the GFP knowledge equation: DESEASE, LABEL, and INNOVATION. All variables had positive and significant effect on GFP knowledge. These results indicated that consumers who declared to have some member of their family with disease, usually paid attention to GFP label when shopping and they like to taste new food products were more likely to have a high knowledge toward GFPs. Self-reported consumer's knowledge (KNOW) variable was statistically significant on the intention to purchase equation. The positive estimated coefficient associated with the KNOW variable indicated that consumers more knowledgeable on GFPs were more likely to be willing to buy them. As Azjen stated, there was a significant relation between the intention to purchase GFPs (INTENTION) and the attitudes toward GFPs [22]. For example, as expected, people who stated that GFP were healthier than conventional ones (HEALTH), did not have secondary effects (EFFECTS) and they were not expensive (CHEEPS), they were more likely to buy GFPs (SWEET).

Finally, regarding socio-demographic variables, as we expected, the estimated coefficient for the variable UNIVER, was negative meaning that people who had lower educational degree were more likely to buy GFPs. Finally, FEMALE variable had positive and significant effects meaning on GFP knowledge meaning that women were more likely to have higher knowledge of GFPs.

The marginal effects were calculated to assess if the exogenous variables affected on the KNOW and INTENTION variables which were ordinal. In the case the exogenous variables were continuous, the marginal effects were calculated by means of the partial derivatives of the probabilities with respect to a given exogenous variable. Nevertheless, if exogenous variables were dummy variables, the marginal effects were calculated taking the difference between the predicted probabilities in the respective variables of interest, changing from 0 to 1 and holding the rest constant.

In **Table 3**, the marginal effects for the continuous variables and for the dummy variables are reported.

With respect to self-reported knowledge on GFPs, the marginal effects indicated that non-celiac consumers who declared to have some member of their family with disease, they used to pay attention to GFP label were more likely to state a medium or higher level of knowledge on GFPs.

Regarding the intention to purchase GFPs, results indicate that female consumers with lower level of education and self-reported GFP knowledge were more likely to buy GFPs. As consumers presented more positive attitudes toward GFPs, they were more likely to buy. Finally, results reported that those consumers who believed that GFPs had secondary effects was not available in the shops, they were less likely to buy them

	Know = 1	Know = 2	Know = 3	Inten = 1	Inten = 2	Inten = 3	Inten = 4	Inten = 5
				-0.05	0.05	0.00	0.05	0.04
Female				0.07	0.05	-0.08	-0.06	-0.05
University								
Disease	0.34	-0.13	0.11					
Label	1.03	0.39	0.29					
New	0.14	-0.05	0.04					
Health				-0.04	0.03	0.00	0.04	0.04
Effect				0.03	0.02	0.00	0.03	0.03
Cheap				-0.03	0.02	0.00	0.02	0.02
Sweet				-0.02	-0.02	0.00	0.02	0.02
Know				-0.10	-0.08	0.01	0.09	0.09

**Table 3.** Marginal effects of knowledge and purchase intention.

## 7. Conclusions and final remarks

The GFP demand has been increasing in popularity among non-celiac consumers since the past decade. In this study, we investigated factors affecting the intention to buy GFP by non-celiac consumers in Spain. To achieve this objective, we conducted a survey in Spain with 222 non-celiac consumers. Generally, results confirmed that knowledge, positive attitudes toward GFPs, tasting new products, gender, and education level influence the intention to buy GFPs.

The marketing implications of these findings are several. Increasing knowledge on GFPs is paramount important to increase intention to purchase and therefore consumption of GF in Spain. Because more knowledgeable consumers are more prone to buying gluten-free products, information campaigns on gluten-free products should be implemented to increase demand for these products. These campaigns should target mainly consumers with lower levels of knowledge, particularly men with no university degree because they were found to be less knowledgeable. On the other hand, paying attention for GF label when shopping, willingness to try new food and beverages, and to have some intolerance to gluten were two distinctive characteristics for knowledgeable consumers. Hence, our findings support that media advertising campaigns providing clear information about GFPs could be a good strategy for GF companies to ensure that their products become known in the Spanish market, targeting women and people with lower level of education.

Further, our findings also showed that consumers who believed that GFPs are healthy, cheap, and did not have secondary effects were more likely to buy GFPs. Hence, in order to encourage the purchase of GFPs, an excellent communication strategy for enterprise is to focus on healthiness of GFP because they do not present secondary effects and they are not expensive with respect to conventional products. In this way, non-celiac consumers would be more prone to buy them.

Finally, GF companies in order to penetrate the Spanish market and to increase their sales afterward could promote tasting promotions at the supermarkets, especially targeting those wine consumers who are more prone to trying new food and beverages. Actually, trying the product for the first time represents the precursor to liking and re-buying.

The main limitation of this study is the hypothetical bias due to the use of self-reported intention to buy GFPs in the questionnaire. Hence, future studies might analyze the final behavior rather intention to buy using non-hypothetical valuation methods, such as Real Choice Experiment and auctions in order to estimate the truthful preferences toward GFPs.

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