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ADHERENCE TO THE GLUTEN-FREE DIET AND PREFERENCES FOR GLUTEN-FREE PRODUCTS

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ABSTRACT

Demand for gluten-free (GF) products has expanded rapidly in the last years due to the increasing number of people diagnosed with celiac disease (CD) and other non-celiac people who follow the diet. To date research has focused on supporting celiac people in following a strict gluten-free diet (GFD) and improving sensorial aspects of GF products. However, research on understanding factors affecting non-celiac consumers who voluntarily follow the diet and on economic aspects of the products is limited.

Thus, this study aims to understand behavior towards GFD and preferences for GF products by celiac and non-celiac consumers. This is necessary firstly to support people to make healthy food choices and secondly direct companies that operate in the GF market towards consumers' requirements for GF products.

In order to discern factors affecting adherence to GFD, a survey was built including factors identified by a systematic review. Celiac and non-celiac people (followers and non-followers of the diet) were invited to participate in the study. Moreover, a discrete choice experiment was designed in order to determine consumers' preferences for brand and label. Again, celiac and non-celiac people were invited to participate in the study. Since discrete choice experiment have never been applied to GF products, attributes and levels were chosen based on results of a qualitative study performed with retailers, consumers (celiacs, family members of celiac and non-celiacs voluntarily following GFD) and a representative of Italian Celiac Association (ICA).

Results show that most of the concerns regarding GF products are about their low sensorial performance, high prices and low nutritional values. Moreover, sometimes, non-celiac consumers lack knowledge about GF food and diet, believing some myths which are not scientifically proven. In adittion results indicate that adherence to GFD is affected mainly by attitudes towards GFD, self-efficacy, injunctive norms, knowledge about GFD and perceptions that GF products are expensive. Furthermore, brand and label are important attributes for consumers. However, only celiac patients are willing to pay a premium price for branded GF pasta.

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Contents

Chapter 1

Introduction

In the recent years consumers are increasing their interest in adopting more healthy lifestyles and are becoming more concerned about food choices (Mollet & Rowland, 2002; Szakály, Szente, Kövér, Polereczki, & Szigeti, 2012). To support this, data from the market show that in 2017, the health and wellness market retail value increased by 3.3% and by 4.2% respectively in the Asia Pacific, and the Middle East and Africa (Angus & Westbrook, 2018). In Europe, the evidence shows that the market value in 2013 was approximately 130 billion Euros, while by the end of 2018 this value is forecasted to reach 149 billion Euros (Statista, 2017).

One such area in which the profile of healthy eating has changed is the “free from gluten” category of food products, which has contributed to the overall growth in the health foods market. According to Angus & Westbrook (2018), the compound annual growth rate for the category “Free from Gluten” has the largest growth for the period (2012-2017); the US, Italy and the UK are the most important contributors to this growth. In fact, in 2016 compared to packaged foods, which has a growth rate of just over 4%, global sales of gluten-free (GF) food jumped to 12.6% (Terazono, 2017). Moreover, the GF retail market is forecasted to expand from $1.7billion that was in 2011 to $4.7billion by 2020 (Terazono, 2017).

However, in order to make precise prediction about the future of the gluten-free market and the demand for gluten-free products, it is necessary to understand consumers’ preferences and needs for this category of products. Hence, the present study aims to understand these trends by considering three important key points: gluten-free diet (GFD); gluten-free (GF) products and consumers’ perspectives.

A Google search of the word “gluten” gives 411 million results while “sustainability”, another concern in the recent years, gives 430 million results. What is gluten and why is everyone talking and searching for it? Gluten is a complex of proteins composed of "gliadins" and "glutenins” found in cereals like wheat, barley, rye, and triticale. Gluten is formed when wheat flour is mixed with a liquid and physically shaped, to mention bread kneading (Skerritt & Hill, 1991). However, in genetically predisposed individuals this protein does not get digested causing the so-called autoimmune disorder celiac disease (CD) (Dickey, 2009). The prevalence of the disease is higher

in Europe and Oceania (0.8% of the population); it mostly affects females and children (P. Singh et al., 2018). Symptoms of CD vary from person to person but typically includes diarrhoea, weight loss, anaemia, fatigue, depression and osteoporosis (Haines, Anderson, & Gibson, 2008; Scherf, Koehler, & Wieser, 2016). Intestinal damage accompanies CD, and intraepithelial lymphocytosis, crypt hyperplasia and villous atrophy characterise it (Marsh, 1992). Diagnose can be difficult because the signs and symptoms are similar to other conditions, but with blood tests and a small intestine biopsy, it is possible to distinguish if a patient is suffering CD (Green, 2005).

To date, the only scientifically proven treatment for the CD is a lifelong GFD, which is complete avoidance of wheat, rye, barley and other gluten-containing grains. Within the first weeks of GFD adoption, 70% of the patient diagnosed with CD declared improvements in the symptoms of the disease (Green et al., 2001). Thus, considering the importance of this diet, it is necessary to identify the food products allowed.

Usually, GF products are split into two groups:

- Foods naturally free of gluten such as fresh meat, fruits and vegetables, honey, dairy products;
- Dietetic (processed) foods that are manufactured using GF ingredients like cereals, principally corn and rice, but traditionally have been produced with gluten containing cereals such as wheat.

However, during production and/or transportation these products might get contaminated. Hence, to assure consumers' health, the European Commission established the Regulation (EC) No. 41/2009 concerning the composition and labelling of foodstuffs suitable for people intolerant to gluten that states that (Article 3):

- "Foodstuffs for people intolerant to gluten, consisting of or containing one or more ingredients made from wheat, rye, barley, oats or their crossbred varieties which have been specially processed to reduce gluten, shall not contain a level of gluten exceeding 100 mg/kg in the food as sold to the final consumer. "
- Products may bear the term 'gluten-free' if the gluten content does not exceed 20 mg/kg in the food as sold to the final consumer."

It is important to notice that in the present study GF products refer to the processed GF products and not natural GF prodcuts.

However, apart from celiac patients, in the recent years, non-celiac consumers are also embracing the GFD. To illustrate, according to the Nielsen report on healthy eating, worldwide, 23% of the participants in the survey avoided gluten (Nielsen, 2015a). In Italy approximately 6 million people follow a GFD voluntarily (Associazione Italiana Celiachia, 2017).

Why non-celiac people follow the diet? Firstly, family members of celiac people are following GFD in order to avoid food contamination at home and since the disease is consider inherited, the GFD might prevent the appearance to other members (Bogue & Sorenson, 2008). Secondly, GFD has been considered as a treatment option for other conditions, to mention some: dermatitis herpetiformis, anemia, irritable bowel syndrome, rheumatoid arthritis, diabetes mellitus, HIV-associated enteropathy and other neurologic disorders (Bürk et al., 2009; El-Chammas & Danner, 2011; Srihari Mahadev et al., 2013; Samasca et al., 2017). Finally, other people who do not have any specific symptoms are recently following the diet, mainly influenced by non-celiac celebrities who consider the GFD as shape keeper and energy giver (Ranker, 2015).

Thus, the GFD is fundamental for those people suffering the CD and others who follow the GFD due to health problems.

However, to date, research has not shown that GFD should be considered as a better diet option for the general population that does not suffer from any specific condition or disease (Gaesser & Angadi, 2012; Marcason, 2011; Niland & Cash, 2018). In line with this, D. Lis, Stellingwerff, Kitic, Ahuja, & Fell, (2015) did not find any effect of the GFD on the overall performance of non-celiac athletes.

However, since the consumption of gluten-free (GF) products is increasing, research continues to investigate the effects of the GFD, especially the nutritional aspects of the diet. Studies on celiac patients following GFD have shown that there is a decrease of carbohydrate intake as fibres and an increase as sugars (Babio et al., 2017; Bardella et al., 2000). Furthermore, regarding proteins, studies have found that GF products have a lower percentage of proteins compared to their counterparts (Estévez, Ayala, Vespa, & Araya, 2016; Tricia Thompson, Dennis, Higgins, Lee, & Sharrett, 2005). However, other studies have shown that the protein intake among GFD followers still meets the nutritional targets (Shepherd & Gibson, 2013; Staudacher & Gibson, 2015). Results regarding fat consumption are also contradictory. Some studies demonstrated that the level of fats in a GFD is sometimes twice of the normal levels (Babio et al., 2017; Barone et al., 2016;

Miranda, Lasa, Bustamante, Churruca, & Simon, 2014), but research conducted in Australia, showed no differences on the fat content between GF products and their counterparts (Estévez et al., 2016; Wu et al., 2015). Regarding micronutrients, research has shown that GF products have a lower content of Vitamin B group, iron, folate, magnesium (T. Thompson, 1999; Wild, Robins, Burley, & Howdle, 2010), manganese (Hallert et al., 2002) and calcium (Kinsey, Burden, & Bannerman, 2008; Shepherd & Gibson, 2013).

Concerning other aspects of GF products, studies have shown that they are:

- less tasty than conventional foods (Arendt & Dal Bello, 2008; Arendt, O'Brien, Gormley, & Gallagher, 2002; Do Nascimento, Fiates, Dos Anjos, & Teixeira, 2014)
- are more difficult to find at the grocery shops and/or supermarkets (do Nascimento, Medeiros Rataichesck Fiates, dos Anjos, & Teixeira, 2014; Ferster, Obuchowicz, Jarecka, Pietrzak, & Karczewska, 2015; J. Singh & Whelan, 2011)
- are expensive (Fry, Madden, & Fallaize, 2018; Missbach et al., 2015b; J. Singh & Whelan, 2011)

1.1 Research objectives

Following GFD is strongly related with the well-being of the people suffering from CD. However, the reasons why non-celiac people follow a GFD remain unclear. Therefore, the first objective of this research is to understand consumers' behaviour, celiac and non-celiac, towards GFD. This goal is important from a policy perspective, especially for people who follow the diet not because of health problems. Institutions, managing CD and GFD, should also consider the concerns of the healthiness of the diet and should do more about informing the interesting parts about the real effects of the diet for the normal population.

Moreover, since the GF market is expanding, the second aim of this study is to understand preferences for GF products by considering the situation in Italy, which, as it was shown at the beginning of this chapter, is one of the main contributors of the growth of the GF market. This goal is meaningful for the business that is already in the market or is considering to enter the GF market. It is important that they have a clearer perspective of the future of this market; potential consumers and their preferences for the products.

Hence, the present study lays out the following questions:

- How to improve adherence to GFD of celiac and other people who follow the diet because of health problems? Is there any possibility for non-followers of the diet to engage in the GFD?
- Why non-celiac people are ready to pay higher prices and engage in a diet which has not been scientifically proven to be healthier than other options?
- Which are the attributes consumers appreciate the most about the GF products?
- What are the differences between celiac and non-celiac people?

In order to reply to these questions, the current study will firstly investigate the factors affecting adherence to GFD and secondly will identify preferences and willingness to pay (WTP) for GF pasta.

1.2 Outline of the study

This research comprises five essays:

1) A systematic review of the factors affecting adherence to GFD, which aims to understand factors affecting adherence to GFD and to discern differences between celiac and non-celiac consumers. The systematic review was conducted by considering the PRISMA protocol.

2) A qualitative study on the purchase experience of consumers for GF products. The qualitative study was conducted through semi-structured interviews with a rapresentative of the Italian Celiac Association (ICA), retailers and consumers (celiac and non-celiac consumers) buying GF products and family members of celiac people.

3) Empirical research about the behaviour towards GFD. It aims to model the behaviour towards GFD by considering theoretical health behaviour models. The study was conducted through online questionaires which were designed by considering the findings of the first essay.

4) Emprical research on preferences and WTP for GF pasta with Teff. Its aim is to understand consumers' preferences and WTP for GF pasta with Teff. A survey and a choice experiment were applied in order to achieve the objective of the study. We considered pasta since Italy is the first producer and the first consumer of the product in the world (Union of Organizations of Manufactures of Pasta Producers, 2015)

5) Concluding chapter, which summarizes the main results of the study.

Figure 1-1 is a graphical representation of the current study.

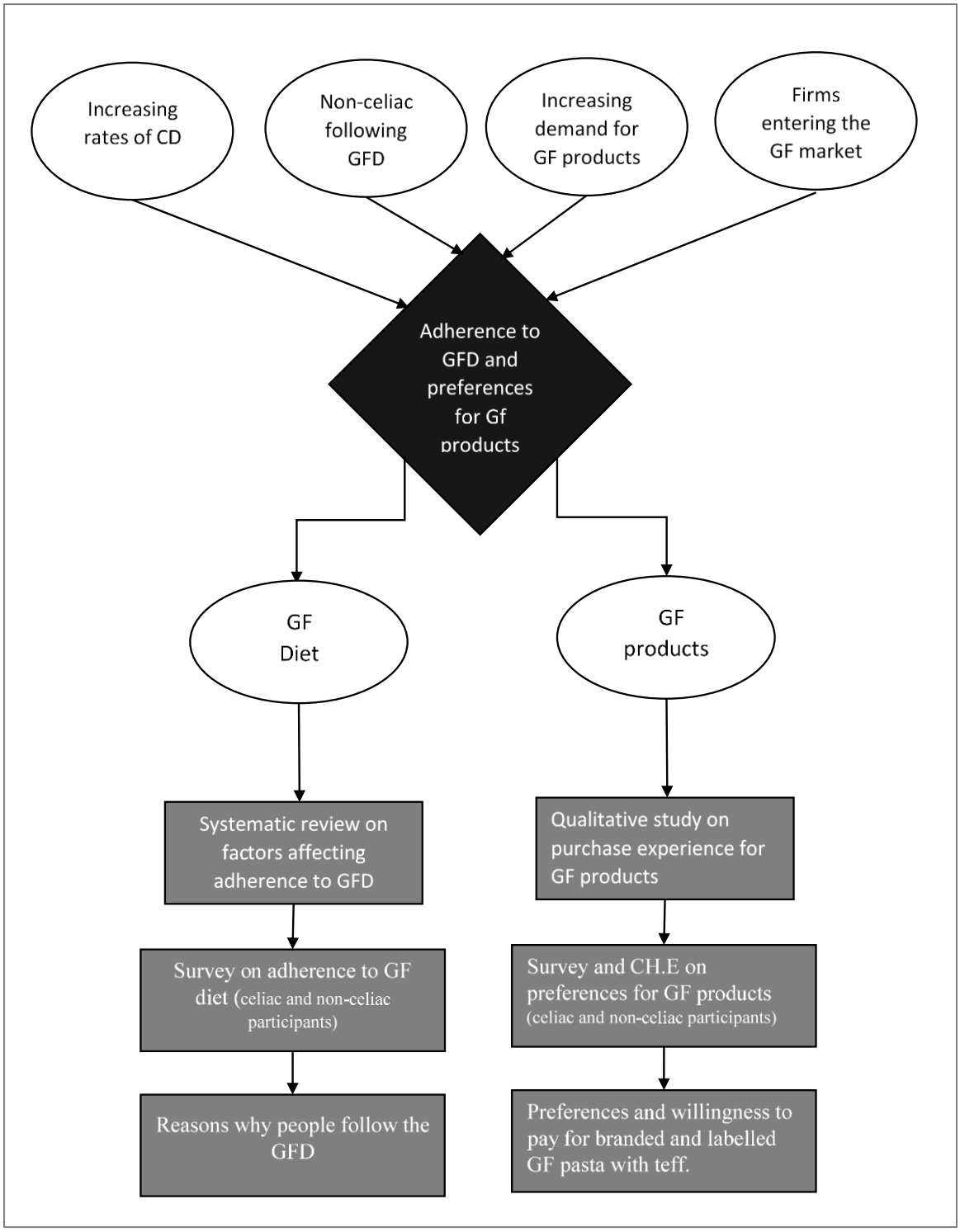

Figure 1.1 Adherence to GFD and preferences for Gf products. Flow chart.

Chapter 2

Factors Affecting Consumers' Adherence to The Gluten-Free Diet, A Systematic Review[1]

Abstract

Background: The gluten-free market is expanding rapidly. The reasons for this reflect a growing interest in adopting a gluten-free diet (GFD). This is partly explained by an increasing number of people diagnosed with Celiac Disease (CD), but also because of public perceptions that a GFD is a healthy diet option. However, pro-ducts specifically marketed as gluten-free (GF) are reduced in several sensorial characteristics, are more ex-pensive, and have lower nutritional values than comparable alternatives. *Scope and approach:* The aim of this review is to provide an up-to-date set of factors that underpin consumers' preferences and adherence to GFD. After screening, 54 articles were considered for the review. *Key findings and conclusions*: The review classifies the factors affecting GFD in eight groups: “Factors specific to the GFD”; “Socio-demographic factors”; “GF products' factors”; “Psychological Factors”; “Symptoms related to Celiac”; “Celiac Disease's factors”; “Quality of Life”; “Other Factors”. Results on the level of association and significance of the factors affecting adherence to GFD are mixed. Moreover, in the process of reviewing the literature, this review reveals that most of the studies that have investigated factors associated with adherence to GFD are focused primarily on celiac patients while neglecting the fact that many non-celiac adopt the diet. From this we discuss future research directions, and what questions remain unanswered in the domain of adherence to the GFD.

Keywords: Gluten-free product, Diet, Adherence, Celiac disease, Non-celiac, Willingness to pay

2.1 Introduction

Over the last century, human life expectancy has increased, from approximately 29 years of age in 1800 (The World Bank, 2004) to 63 years of age in 2018 (World Health Organization, 2018). For

This chapter largely draws from Xhakollari, V; Canavari, M & Osman M. (2019). Factors affecting consumers' adherence to gluten-free diet, a systematic review. Trends in Food Science and Technology, 85, pp. 23 – 33. doi.org/10.1016/j.tifs.2018.12.005

the most part, this increase is the result of consumers valuing and adopting healthy lifestyles (Szakály et al., 2012), underpinned by a perception that food directly affects health (Mollet & Rowland, 2002). This perception has helped to increase demands for food products, which are being perceived, as well as, having health benefits. In 2017, the health and wellness market retail value increased by 3.3% and by 4.2%, respectively, in the Asia Pacific, and the Middle East and Africa (Angus & Westbrook, 2018). In Europe, the evidence shows that the market value in 2013 was approximately 130 billion Euros, and in 2018 this value is forecasted to reach 149 billion Euros (Statista, 2017).

One such area in which the profile of healthy eating has changed is the "free from gluten" category of food products, which has contributed to the overall growth in the health foods market. Products may bear the term 'gluten-free' if the gluten content does not exceed 20 mg/kg in food items sold to the final consumer ("(EU) No 828/2014," 2014). However, it is important to notice that, in this review, the term "GF product" refers to dietetic (processed) gluten-free foodstuff that is manufactured using GF ingredients like cereals, principally corn and rice, in substitution of the regular gluten-containing ingredients. To mention some products of these categories: bread, biscuits, pasta, pizza, bakery products. According to Angus & Westbrook (2018), the compound annual growth rate for the category "Free from Gluten" has the largest growth for the period (2012-2017); the US, Italy and the UK are the most important contributors to this growth. In fact, in 2016 compared to packaged foods, which has a growth rate of just over 4%, global sales of gluten-free (GF) food jumped to 12.6% (Terazono, 2017). Moreover, the GF retail market is forecasted to expand from $1.7billion in 2011 to $4.7billion by 2020 (Terazono, 2017).

Given the general pattern of global growth in the demand for GF food, it is worth understanding how and why this has occurred. This review aims to understand GF market trends by examining several economic and psychological factors and the risks that this market faces.

For instance, celiac people that are required to follow a strict gluten-free diet (GFD) for health reasons contribute to the rise in the market for GF products, but also their family members and other non-celiac people are also embracing this diet. Moreover, other people suffering from non-celiac gluten sensitivity and wheat intolerance are recommended to reduce the intake of gluten in their diet, even though the latter, unlike celiac disease, are not considered autoimmune diseases (Newberry, McKnight, Sarav, & Pickett-Blakely, 2017). However, recent work on GF food highlights that GF products, such as pasta, have low nutritional value (Wu et al., 2015), as well as

limited availability and are more expensive than comparable alternatives (do Nascimento, Medeiros Rataichesck Fiates, et al., 2014). Nevertheless, despite these limiting factors, as mentioned, the GF market is one of the fastest growing food product lines in the health foods market. Therefore, understanding the factors, which affect adherence to a GFD, is of relevance because it gives some indication of how and why there is an increasing appetite for this type of food product. For instance, why is that despite GF products having low nutritional properties and high prices is the market growing? Especially when gluten-containing alternatives have higher nutritional values and are cheaper?

Thus, one of the key objectives of this paper is to give an overview of factors most commonly related to adherence to a GFD. This subject has been of interest to researchers, but the most prominent review of this literature by Hall, Rubin, & Charnock (2009) involved a systematic review of articles from 1980 to 2007, which is now ten years out of date. They analysed factors affecting adherence to GFD but specifically on work examining only celiac patients rather than non-celiac as well. Hall et al. (2009) found that the lowest adherence was among ethnic minorities and those diagnosed with celiac disease (CD) in their childhood. Furthermore, they found that emotional and socio-cultural influences, membership of an advocacy group and regular dietetic follow-up are factors most typically associated with strict diet adherence. The most recent systematic review to date by Sainsbury & Marques (2018) focused on the relationship between depressive symptoms and adherence to GFD by celiac patients. They found that there was a moderate relation between high depressive symptoms and low GFD adherence. However, the evidence base was limited, and any conclusion drawn from this work should be considered with some caution.

Nevertheless, both, Hall et al. (2009) and Sainsbury & Marques (2018) did not account for potential economic factors associated with a GFD although they might play an essential role in explaining the increasing demand for GF products.

Moreover, both studies did not discuss how specific characteristics of GF products might affect the adoption of GFD, as well as why non-celiac people also adopt a GFD. Finally, Hall et al. (2009) review the literature on GFD adherence until 2007, so it is useful to check whether their findings still apply.

Moreover, both studies did not discuss how specific characteristics of GF products might affect the adoption of GFD, as well as why non-celiac people also adopt a GFD. Finally, Hall et al. (2009) review the literature on GFD adherence until 2007, so it is useful to check whether their findings still apply. By providing a more comprehensive evaluation of the factors that inform the current trend in adopting a GFD, this review not only is of benefit to researchers but also has a value from an applied angle. For instance, a review of this kind would help GF industries to identify and respond to the specific needs of their target market, celiac consumers, as well as non-celiac populations that proactively follow a GFD.

The rest of the article is organised as follows: Background section will introduce the increasing trends of CD and adherence to the GFD worldwide and will give some details regarding GFD and GF products; the search strategy explains the way relevant articles were selected and analysed; the Main findings section of this systematic review presents a description of the results from the selected papers; the Discussion section provides an overview of the key findings and how they inform the objectives of this review, and the final section includes a discussion on new directions for research that would help strengthen our understanding of the growing interest in adopting a GFD.

2.2 Background

The GFD is the only currently available treatment for the CD. Thus, the increasing number of people affected by the disease is one of the most important indicators when forecasting the growth of the GF market. The CD is considered to have an "international face" since it is globally recognised as a disease (Alaedini & Green, 2005; Niewinski, 2008). Worldwide, 1-2% of the population is considered to suffer from this disease (Green & Cellier, 2007; Leffler & Schuppan, 2010), but there is speculation that the real percentage is higher. For instance, according to the Italian Ministry of Health, in 2016 the celiac population of Italy was 198 427, but other estimates state that the real population might be 407 467 (De Stefano & Silano, 2016).

Also, changes in people's lifestyles and attitudes towards "health" inform interest in the growing adoption of a GFD. For a start, celiac consumers' lifestyle trends are affecting the positive development of the GF market. The market has responded to this increasing demand by

increasing their range of GF products, such as bread, pizza layers, flour, pasta, snacks, cakes, cookies, bars, ready meals and fast foods (Arendt & Dal Bello, 2008).

Moreover, as mentioned earlier, it is worth highlighting that the celiac population is not the only one consuming GF products, but recently non-celiac people are voluntarily adopting the GFD. For instance, in Italy, 6 million non-celiac people follow the GFD, spending approximately 105 million Euro/year on GF foods (Associazione Italiana Celiachia, 2017). Moreover, 37% of people under the age of 20, and 31% of people under the age of 34 are willing to pay a premium price for GF products (Nielsen, 2015b). The motivations for this are varied. For instance, family members of celiac patients follow a GFD at home to avoid food contamination. Furthermore, since the disease is inherited, adopting a GFD is thought to prevent the presence of the disease in other family members (Arendt & Dal Bello, 2008). Also, according to Arendt & Dal Bello (2008), there are perceptions that a GFD positively impacts other conditions such as autism, and other food allergies, as well as intolerances to wheat, eggs, soy, and milk.

Another reason that non-celiac people likely follow a GDF is that it is a fashionable lifestyle trend. Non-celiac consumers are often influenced by non-celiac celebrities who consider the GFD as a way to stay in shape and as a means to increase energy levels ("Celebrities Who Are GF | InStyle.com," n.d.). For instance, famous sports people have publicly discussed how GFD has positively changed their life, such as Novak Djokovic, a world-famous tennis player, who reported on this in his book "Serve to Win" (2013).

Thus far, this discussion has considered, in broad terms, a range of possible factors that contribute to understanding the growing market of GF food products, and the reasons for adopting a GFD. In the following discussion, we also introduce some limiting factors associated with GF products. These include the nutritional value, taste, availability, and price of GF products which could present threats for the future of the GF market unless the market takes these issues into account.

With regards to nutritional value, according to Wu et al. (2015), the Health Star Rate (HSR)[2] for GF dry pasta is 0.5 stars less than conventional counterparts. Furthermore, many studies suggest that when compared to conventional equivalent food items, GF products consistently have a lower

[2]A nutrient profiling scheme endorsed by the Australian Government. The Health Star Rating is a front-of-pack labelling system that rates the overall nutritional profile of packaged food and assigns it a rating from ½ a star to 5 stars. It provides a quick, easy, standard way to compare similar packaged foods. The more stars, the healthier the choice (Wu et al., 2015).

content of proteins (bread and pasta) (Missbach et al., 2015; Wu et al., 2015), higher content of fat and sodium, fewer minerals and vitamins (Pellegrini & Agostoni, 2015) and low levels of carbohydrates and fibers (Churruca et al., 2015). Wild, Robins, Burley, & Howdle (2010) reported that followers of the GFD have a lower intake of magnesium, folate, iron, selenium, zinc and manganese. Moreover, when taking GF biscuits as an example, they claimed that commercially available GF biscuits were richer in saturated fat than their gluten-containing equivalents. Thus, from a nutritional standpoint, the evidence suggests that, unlike the perception of GF products being healthy, they are objectively lower in nutritional value. If consistently adopted into consumers diets, GF products pose problems because they lack necessary nutrients that should be present in a healthy diet.

Furthermore, there is evidence to suggest that, GF products, like bread, pizza and biscuits are judged as less tasty than conventional foods (Arendt & Dal Bello, 2008; Arendt, O'Brien, Gormley, & Gallagher, 2002; Do Nascimento, Fiates, Dos Anjos, & Teixeira, 2014). In a survey commissioned by the Gluten Intolerance Group of North America in 2009, 71% of participants agreed with the statement "It is hard to find good tasting gluten-free products". Several studies also suggest that when choosing functional foods, taste is one of the most important sensory features compared to look and smell, in particular for GF products (Grunert, Bech-Larsen, & Bredahl, 2000; Olsson, Hörnell, Ivarsson, & Sydner, 2008; Urala & Lähteenmäki, 2003). Nevertheless, recent work looking at attempts to improve GF products' taste characteristics, suggests that they pose additional problems (Capriles, dos Santos, & Arêas, 2016; Elisa Carvalho De Morais, Cruz, & Bolini, 2013; E. C. Morais, Cruz, Faria, & Bolini, 2014). To entice customers, by making GF products tastier, the methods used to improve the sensory properties of GF products still present a challenge for producers. That is to say, the increase in sugar and salt content aimed at increasing the taste of GF products, in turn, makes them even unhealthier. However, research on this topic is advancing, and there are attempts to develop new food products with improved sensorial and, importantly, improved nutritional profiles (A. Singh & Kumar, 2018)

Finally, research has studied the availability and costs of GF products. According to Missbach et al. (2015), GF cereals, bakery and bread products are +205% and +267% higher in price compared to their gluten-containing counterparts. Furthermore, Singh & Whelan (2011) found that the price of GF pasta, in both quality supermarkets ($0,8 per 100 g) and health food shops ($ 1.04 per 100 g) is higher when compared to regular supermarkets ($ 0.62 per 100 g). They also found that the

cost of GF bread is approximately 360% higher compared to gluten-containing alternatives. Also, the availability of GF products in Brazil, the UK and Poland is considered limited (do Nascimento, Medeiros Rataichesck Fiates, et al., 2014; Ferster et al., 2015; J. Singh & Whelan, 2011). For instance, in a study conducted in the UK in 2010 on 30 different food outlets, regular supermarkets' stock of gluten-free products and corner shops did not offer any discount on GF products (J. Singh & Whelan, 2011).

As highlighted earlier, the demand for GF products is increasing rapidly, and it is forecasted to rise. This likely means that more firms will be tempted to enter the promising GF market and thus it is important to have adequate information about consumers' expectations of GF products, as well as understanding the critical factors affecting adherence to the GFD.

Thus, this systematic review addresses the following issues:

- Identify the most important factors affecting adherence to GFD
- Analyse the most relevant attributes regarding willingness to pay (WTP) and intention to buy GF products
- Understand differences between celiac and non-celiac followers of a GFD

2.3 Search strategy

2.3.1 Selection of articles

The review was conducted by considering the PRISMA protocol, which contains a checklist with 17 items considered to be essential and minimum components of a systematic review or meta-analysis protocol (Shamseer et al., 2015). At first, an initial pool of studies was built by running searches in several key databases: Scopus, Web of Science, Elsevier's Science Direct, AgEcon Search and Econ Papers. Three searches were conducted in each of the databases above:

- Selecting articles related to adherence to GFD by using keywords: "gluten-free", "diet", "adherence", "adults."
- Selecting articles related to willingness to pay (WTP) for GF products by using keywords: "gluten-free", "willingness to pay."
- Selecting articles related to intention to buy GF products by using keywords: "gluten-free" and "intention to buy".

Studies considered for this review were assessed for the period January 2008 to September 2017, since, as reported in the previous section, Hall et al. (2009) conducted a systematic review from 1980 to 2007.

Figure 2-1 shows the process of collecting, extracting and selecting articles for this review.

First of all, duplicates were excluded, and only articles from academic journals, conference proceedings, books, thesis, and dissertations were considered for the next screening process. Thus, articles, which contained empirical studies were selected based on the following criteria:

- Published in English/Italian/Spanish language (languages spoken by the authors)
- Exclusion of review articles
- Studies on adult populations

During this screening, articles were selected by considering the presence of the words “gluten-free”, “diet”, willingness to pay” and “intention to buy” in their titles. At the third step, 863 abstracts were assessed for eligibility, and 681 articles were dropped since they did not meet the criteria outlined. From this, 182 articles’ text were evaluated and only 54 articles were considered as meeting the full criteria of this systematic review.

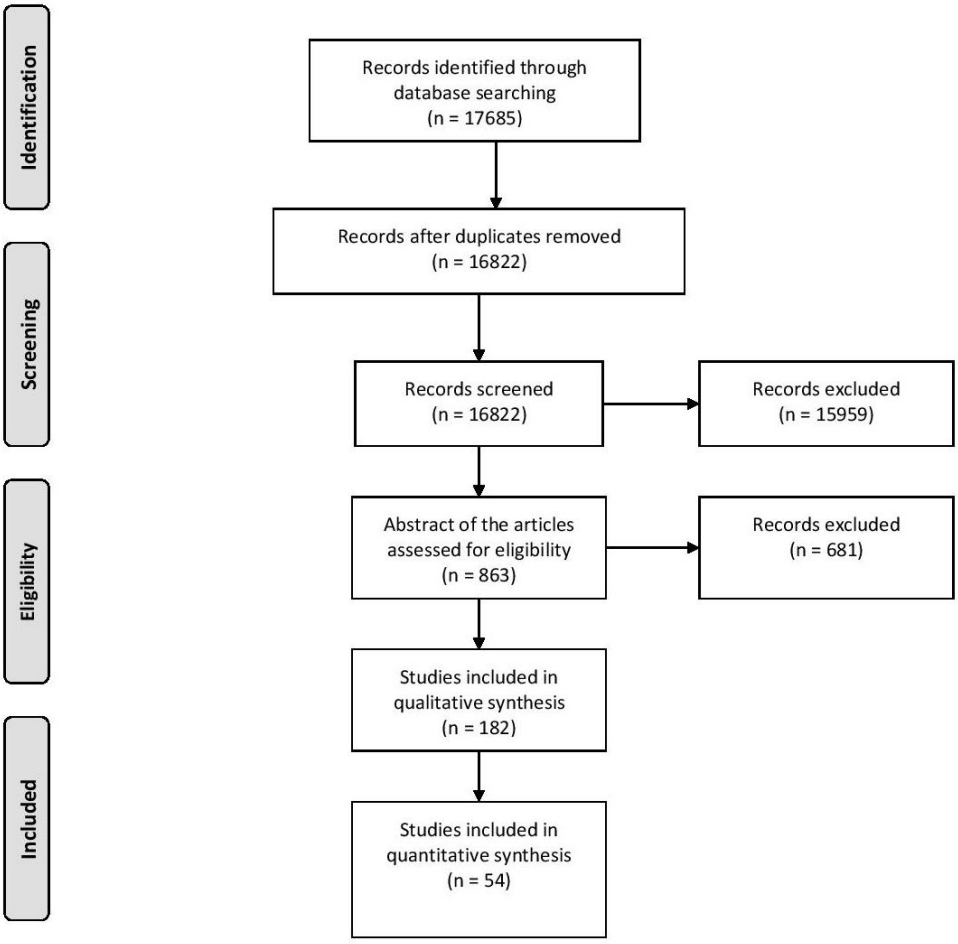

Figure 2. 1 Adherence to the gluten-free diet PRISMA flow diagram

2.3.2 Data extraction

Information extracted from the articles of this review was on 1) Location, since the research has shown that CD rates are higher in western countries and among white people (Di Sabatino & Corazza, 2009); 2) Whether participants were celiac or not because many non-celiac consumers appear to be following a GFD.

Moreover, given that one of the objectives of this review is to determine factors affecting GFD, the selected articles were assessed concerning the type of variables (factors) they studied. To the best of our knowledge, there is no scientific methodology which describes the way independent factors are classified. However, to fulfil the first objective, the classification was established according to the type of variables most commonly studied, the themes the studies typically discussed, and the core description of the findings provided by the studies.

2.4 Main findings

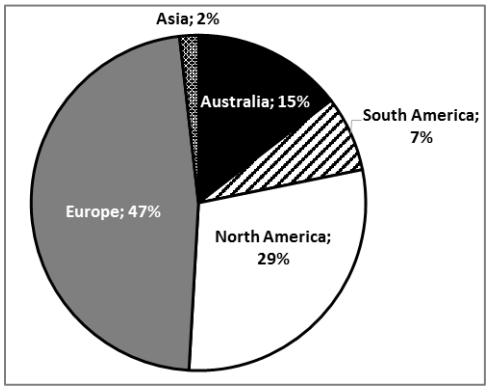

Figure 2. 2 Location of the studies

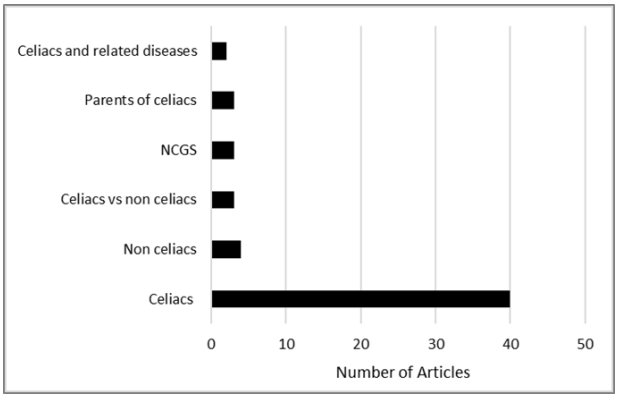

Figure 2. 3 Specification of the subjects

Figure 2-2 shows the location where the selected articles for this review were carried out. As can be seen, most of the studies were conducted in Europe (mainly in the UK and Spain), and North America (mainly in the USA). Also, another key factor that is common to most studies, shown in Figure 2-3, is that they focus primarily on celiac patients.

Regarding the type of method used, most studies used a quantitative approach. Seven studies used a qualitative approach to assess factors affecting adherence to the GFD, with the sample size varying from 7 to 203 participants. Furthermore, the majority of the articles used a survey method in order to identify factors affecting adherence to the GFD and in most cases adherence was measured by a validated scale developed by Morisky, Ang, Krousel-Wood, & Ward (2008)[3].

Looking across the factors that emerge from the studies, those appearing more frequently that were related to the GFD's adherence can be classified in to eight factors (Figure 2-4): "Factors specific to the GFD"; "Socio-demographic factors"; "GF products"; "Psychological Factors"; "Symptoms related to Celiac"; "Celiac Disease's factors"; "Quality of Life"; "Other Factors". The rest of this section reports findings organised according to the classification of these eight factors.

[3] Please refer to section 7.1 for a detailed information on the methods and the main results of the studies included in this review.

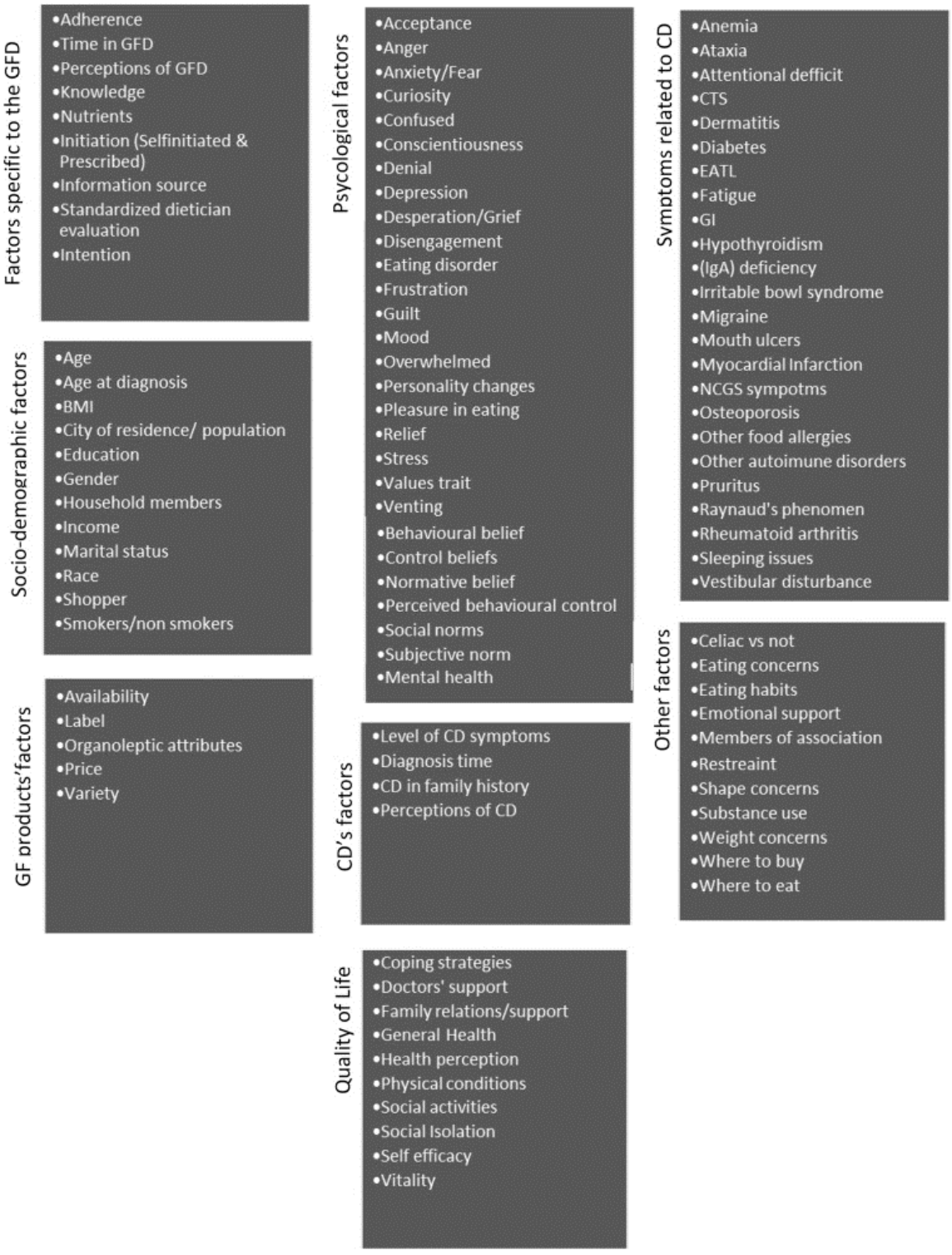

Figure 2. 4 Factors affecting adherence to GFD

Factors specific to the GFD: Many studies show that adherence to GFD is also correlated with different aspects of the GFD. These include attitudes towards the diet, knowledge about the diet, length of following the GFD, and other factors described in the section 7.1 of supplementary material and Figure 2-4. Time of adopting the GFD, perceptions of GFD, and knowledge about the diet, are the factors most commonly studied. According to Tursi, Elisei, Giorgetti, Brandimarte, & Aiello (2009), after 6.5 years of following the GFD physiological health complications appeared. In contrast, Zarkadas et al. (2013) and Van Hees, Van der Does, & Giltay (2013) found that psychological factors improved. Negative emotions and depressive symptoms decreased in participants following a GFD for more than five years. Adherence to GFD has also been shown to positively correlate with perceptions of improvements following the diet (Leffler et al., 2008; Lis, Stellingwerff, Shing, Ahuja, & Fell, 2015a; Sainsbury, Mullan, & Sharpe, 2013a, 2015a, 2015b; Ukkola et al., 2011). Moreover, adherence to GFD is also positively correlated with knowledge about the diet (Ford, Howard, & Oyebode, 2012; Rocha, Gandolfi, & Dos Santos, 2016; Sainsbury, Mullan, & Sharpe, 2013b; Sainsbury et al., 2015a; Silvester, Weiten, Graff, Walker, & Duerksen, 2016; Tomlin, Slater, Muganthan, Beattie, & Afzal, 2014; Verrill, Zhang, & Kane, 2013; Villafuerte-Galvez et al., 2015). This association suggests that for the celiac population, being informed about the diet (whether or not it substantively improves health and wellbeing) is associated with the likelihood of adopting the diet.

Regarding non-celiac participants, according to Lis, Stellingwerff, Shing, Ahuja, & Fell (2015b), GFD was mostly self-initiated by non-celiac people and commonly associated with perceptions regarding the positive health benefits of adopting the diet. However, one limitation with this study is that it did not report significance levels and effect sizes in the analysis of this association. In their study with non-celiac gluten sensitivity participants, Biesiekierski, Newnham, Shepherd, Muir, & Gibson (2014) found that 44% of participants self-initiated the GFD, and only 27% had any detailed knowledge about the diet. Thus, suggesting that for non-celiac participants, perception rather than knowledge may be the primary contributor to adopting the diet. Consistent with this speculation, when comparing celiac and non-celiac people, it was observed that non-celiac and their knowledge about the diet was poor (J. A. Silvester et al., 2016; Verrill et al., 2013), and that they were also less likely to consult health professionals about adopting a GFD (J. A. Silvester et al., 2016).

Socio-demographic factors: Based on our sample of studies, 30 take into account Socio-demographic factors when studying the adherence to a GFD. Corposanto et al. (2015) found that young adults with higher education and seeking employment for the first time have a higher probability of ingesting gluten and fail to follow a GFD consistently. In line with this, Ukkola et al. (2012) found that young people are more dissatisfied with the diet and consequently are more prone to the transgression of a GFD later in life. Among other demographic factors, Paarlahti et al. (2013) showed that the age of diagnosis affected the measure of Quality of life (QOL) and adherence to a GFD. In addition, Kurppa et al. (2013) found that diagnosis at a younger age, especially teenage years, was associated with increase transgression of a GFD later in life. Further, Kautto et al. (2016) found that younger men have difficulty in recognizing that they have a chronic disease. However, other studies consider education as an important predictive factor when analysing adherence to a GFD. These studies show that participants with a higher level of education have higher rates of adherence (Barratt, Leeds, & Sanders, 2011; Shah et al., 2014; Tomlin et al., 2014; Villafuerte-Galvez et al., 2015). However, there are conflicting findings from Mahadev et al. (2013) that found that age, gender, and education level were not associated with diet adherence.

Regarding non-celiac consumers, the majority of GFD followers were females aged between 31-40 years (D. M. Lis et al., 2015a). When comparing celiac and non-celiac, the data show that females of both groups had fewer difficulties in following the GFD (Shah et al., 2014; Verrill et al., 2013). Thus, the overall pattern indicated here is that younger populations struggle to maintain a GFD, particularly younger men, and that whether or not they are celiac, women are more likely to stick to a GFD.

Factors associated with GF products: As mentioned in the Background section of this article, there is work suggesting that GF products are associated with reduced sensorial experience, high prices and low availability. Consequently, these factors affect adherence to GFD. Costs of GF products are the most important when following a GFD and most of the dieters are dissatisfied with the high prices (Araújo & Araújo, 2011; do Nascimento, Fiates, dos Anjos, & Teixeira, 2014; Leffler et al., 2008; Lin, 2007; Villafuerte-Galvez et al., 2015). Moreover, reduced availability is a serious issue. According to Araújo & Araújo (2011), approximately 67% of participants consumed gluten in their diet because of the lack of availability of GF products. In line with this do Nascimento,

Fiates, dos Anjos, & Teixeira (2014) found that 71% of participants in their study reported having moderate to high difficulty in finding GF products.

Moreover, another relevant factor affecting the adoption of a GFD is related to GF product labelling. Since most of GFD's followers read food product labels more carefully because they incur serious consequences if they do not, by necessity, they are required to be more careful about what they are ingesting (Araújo & Araújo, 2011). Research suggests that GFD adherence and reading/understanding labels were positively correlated. In line with this, Verrill, Zhang, & Kane (2013) showed that attention to food labels further increased the likelihood of following a GFD. In additional support, Muhammad, Reeves, Ishaq, Mayberry, & Jeanes (2017) found that not understanding food labels and not being a member of celiac association increased the risk of ingesting gluten and consequently not following a strict GFD. Poor food labelling also has serious consequences. Ferster et al. (2015) reported that in Poland GF products are inadequately labelled, which may also impact adherence to the diet. What appears to be a consistent finding from this work is that there is convergence in showing a relationship between attention to, and labelling of GF product and adherence to a GFD.

The price of GF products ought to be another key factor that is instrumental when considering adherence to GFD. However, to date, there has been little by way of empirical research investigating how price/labelling of GF products affects willingness to pay (WTP), and no studies have been carried out to understand how WTP is associated with GFD adherence. Only three papers were found to be broadly relevant on this topic, De-Magistris, Xhakollari, De, & Rios (2015); de Magistris, Belarbi, & Hellali (2017) and de Magistris, Xhakollari, & Munoz (2015). The studies were conducted in Spain (Zaragoza) with non-celiac consumers. These studies found that when comparing GF against conventional snacks, consumers' evaluation of characteristics related to taste, smell and sight was similar for both products. However, taste and smell did not influence WTP for the GF snack (De-Magistris et al., 2015).

Moreover, de Magistris, Xhakollari, & Munoz (2015), showed that non-celiac consumers were not willing to pay a premium price for the GF snack, suggesting that the labelling does not affect the confidence and loyalty of non-celiac consumers towards these product types. Also, socio-demographic factors appear to affect intention to buy for GF products, suggesting that better knowledge and positive attitudes towards GF products is positively correlated with intention to buy (de Magistris, Belarbi, & Hellali, 2017). Hence, increasing knowledge towards GF products and

considering them as healthy, cheap, and not having adverse side effects might increase the possibility of non-celiac consumers buying GF products. However, it is worth highlighting that no studies to date have been carried out regarding the association between the price of GF products and adherence to a GFD with celiac consumers.

Psychological Factors: Following a strict diet has consequences for mental health, and many studies have taken this into account when studying celiac disease (Ford et al., 2012; SriHari Mahadev, Gardner, Lewis, Lebwohl, & Green, 2015; Rocha et al., 2016; Rose & Howard, 2014; Sainsbury & Mullan, 2011; Sainsbury et al., 2013b; Sainsbury, Mullan, & Sharpe, 2015c). Mental health issues, such as depression and anxiety, are the most commonly associated illnesses with celiac patients. For celiac patients, the findings show that depression and anxiety negatively affect adherence to the diet (Arigo, Anskis, & Smyth, 2012; Barratt et al., 2011; Bürk et al., 2009). Regarding non-celiac gluten sensitivity, Peters, Biesiekierski, Yelland, Muir, & Gibson, (2014) found that this population report suffering depression when exposed to gluten. However, Silvester et al. (2016) found that non-celiac participants experienced less depression and anger when compared to celiac participants. The reasons behind why it is that celiac patients suffer from depression and anxiety are likely different to the reasons that non-celiac people report suffering from depression. However, as yet, no work closely compares the two populations to determine what the critical aetiology is in both.

Factors related to CD and other symptoms: Symptoms and perceptions related to CD also impact adherence to GFD. According to Tursi, Elisei, Giorgetti, Brandimarte, & Aiello (2009), almost half of the participants with CD and subclinical CD did not fully adopt a GFD. In line with this, Ukkola et al. (2012) found that patients with extraintestinal or asymptomatic symptoms were highly disapproving of a GFD compared to those with CD. Moreover, it is relevant to mention that CD is accompanied by other symptoms that include: Ataxia, Attention deficit disorder, Stance and Gait problems, Vestibular disturbance, Carpal tunnel syndrome, Migraine (Bürk et al., 2009); other food allergies (Addolorato et al., 2008; Edwards George et al., 2009; Hernandez & Ruiz, 2014; Leffler et al., 2008; Paarlahti et al., 2013; Silvester et al., 2016; Verrill et al., 2013) and Bloating, Fatigue and Pruritus (Barratt et al., 2011; Bürk et al., 2009; Kurppa et al., 2013). While these symptoms have been identified as relevant in association to GF, to date, no evidence has examined if these also impact adherence to a GFD.

Quality of Life and other social factors: According to Whoqol Group (1995), quality of life (QOL) is "*individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns*". Research on CD patients has shown that QOL plays an important role in explaining adherence to GFD. After being diagnosed with CD, lifestyle and diet reshape a patients' social environment and other activities. Where to eat becomes a serious decision, and social activities change dramatically (Araújo & Araújo, 2011; Bacigalupe & Plocha, 2015; Ferster et al., 2015; Leffler et al., 2008, 2017; Zarkadas et al., 2013). Once diagnosed with CD, most GF dieters adopt eating in a more domestic environment, and develop feelings of social isolation (Bacigalupe & Plocha, 2015; Barratt et al., 2011; do Nascimento, Medeiros Rataichesck Fiates, et al., 2014; Rocha et al., 2016; Rose & Howard, 2014; Silvester et al., 2016; Zarkadas et al., 2013). To help with this, medical services' support (Bacigalupe & Plocha, 2015; Srihari Mahadev et al., 2013; Rajpoot & Makharia, 2013; Ukkola et al., 2012) and membership to celiac associations (Muhammad et al., 2017) have been shown to mitigate failure to consistently adopt a GFD. However, the findings are mixed when it comes to self-efficacy (i.e. a sense of personal control) and coping strategies. Some studies show a correlation with adherence to a GFD (Ford et al., 2012; Sainsbury et al., 2013a, 2015c; Villafuerte-Galvez et al., 2015) but other studies found no correlation (Kurppa et al., 2013). Finally, when it comes to work looking at non-celiac people, or comparisons between celiac and non-celiac people, only one study has examined the relations between QOL scores on both these populations. When comparing celiac and non-celiac participants on QOL scores, no reliable differences were reported (Barratt et al., 2011).

In summary, as mentioned in the section on search strategy, there are a host of variables that could have been used to evaluate the studies included in this systematic review. We have focused on the most commonly referred to factors that appear to be of interest to researchers examining potential influences on adherence to a GFD. In the next section, we discuss the implications of the findings reported here, and how they relate to the core objectives of this review.

2.5 Discussion

The market for GF products has increased rapidly in the last few years. This growth has mainly been because of the increasing number of consumers adopting a GFD. Hence, the first objective of this review was to understand factors affecting adherence to GFD and how this can inform the

future profile of the GF market, particularly because there is special interest on sensorial characteristics, price and nutritional values of GF products that in turn likely impacts future adherence to a GFD. Among the eight categories of factors that were identified in this systematic review, the ones which have been most commonly researched are presented in Table 2.1.

Table 2-1 Factors studied the most

Factors specific to the GFD	Time in GFD Perceptions of GFD Knowledge
Personal Factors	Age Age at diagnosis Education Gender
Psychological Factors	Anxiety Depression
Factors related to Celiac Disease	Level of CD symptoms
Quality of Life	Coping strategies Doctors' support Social Isolation

Results from articles included in this systematic review show that for celiac followers of the GFD after six years on a diet, health complications appeared. However, over time, mental health and well-being appear to improve. Also, it was shown that when compared to non-celiac followers, celiac people have a higher level of knowledge about GFD and that this, in turn, impacts a host of other factors regarding the way in which this population engage with GF products (e.g., attention to labelling, WTP). Findings regarding socio-demographic factors showed that young celiac patients are more likely to lapse in strictly following the diet, particularly young men. However, regarding other socio-demographic factors, such as level of education, there are mixed results regarding a strong association with adherence to a GFD.

Strictly adopting a GFD also impacts mental health and the QOL. The review revealed that the level of depression and anxiety is higher for celiac followers compared to others who voluntarily follow the GFD, or who follow the diet because of other symptoms. Furthermore, studies suggest

that celiac followers have a low QOL, but only one study has compared celiac to non-celiac population, finding no differences between the groups. Therefore, it is hard to generate any strong conclusions in this regard.

Another important result of the review is that while the characteristics of GF products are referred to as important factors affecting adherence to GFD, the available evidence on this appears to be scant. Nevertheless, of the work that does exist, price, availability and attention to food labelling are key problems for both celiac and non-celiac followers of a GFD. Moreover, it appears that these factors are more salient in adopting a GFD than the nutritional value of GF products. This saliency is particularly worrying given that the nutritional value of many GF products is low on a variety of core dimensions, which is likely to impact maintaining a healthy diet.

The second objective of this systematic review was to understand the attributes that affect WTP and the intention to buy GF products. Again, the general literature suggests that there is a significant mark up on GF products regarding pricing compared to equivalent alternatives. The search of the databases found few articles focusing on WTP, and intention to buy GF products. Clearly, there is a mismatch in the trends regarding the economic factors that have been reported in research, and research directly looking at how these factors impact adherence to a GFD. Of the work that does exist, studies have measured how sensorial characteristics and labelling of GF products affect WTP. The findings show that taste, smell and socio-demographic factors did not affect the WTP, specifically for GF snacks. Participants positively evaluating the GF snacks based on texture were more likely to pay a premium price for GF snack. Again, the nutritional content did not appear to be a salient factor in determining WTP.

The third objective of this systematic review aimed to shed light on differences that exist between celiac, non-celiac population and family members of celiac people adhering with GFD. Overall, most studies have tended to focus specifically on celiac populations, with few studying non-celiac samples – despite this making up a large proportion of those buying GF products. Also, few studies directly compare both groups. Hence, drawing any broad comparisons between celiac and non-celiac groups is likely to be biased, for the reason that the populations, at least from the existing literature, as limited as it is, suggests that they differ on several impact factors (e.g., motivation, knowledge about GFD, attention to labelling, mental and physical health issues). Thus, further research is necessary for comparing these two groups because without direct comparisons of both groups it is difficult to meaningfully suggest ways to support and increase adherence to GFD for

celiac patients. It is also difficult to help guide non-celiac followers into making healthy food choices given their differences in knowledge and perceptions of the benefits of a GFD, given that their understanding and motives are likely to differ from celiac patients. Moreover, there is work suggesting that patients with CD are more likely to be overweight and obese as a result of a GFD (Theethira & Dennis, 2015). According to Kabbani et al. (2012), for celiac patients, following a GFD, after three years their body mass index (BMI) was higher when compared to the initial phase. This situation is true for all age groups. According to Norsa et al. (2013), in Italy, the prevalence of obesity increased by approximately 3% among celiac children following a GFD for at least one year. Furthermore, Wild et al. (2010) showed that, in the UK, when compared to non-followers of the GFD and non-celiac population, female celiac patients consumed a higher level of calories due to the high intake of sweet snacks. However, to the best of our knowledge, there is no work examining the impact of a GFD on weight gain amongst non-celiac people following a GFD. More to the point, in light of these findings, identifying factors associated with adherence to GFD from non-celiac people is crucial in helping firms develop healthier food choices.

In conclusion, the increasing demand in adopting GFDs and consumption of GF products is a phenomenon that is not only of interest to firms but also has important implications for populations of celiac and non-celiac people that are adopting the diet. This systematic review has revealed that research regarding determinants of GFD by celiac people is high. However, more research is needed to understand the nuanced differences between celiac and non-celiac populations regarding their adherence to the diet, the impact of the diet on their health and wellbeing, as well as their different needs and understanding of the impact of their diet on their health. Also, research of this kind will help to inform a better understanding of consumers' requirements regarding GF products to direct companies and other relevant institutions towards market demand adequately.

2.6 Future research

This systematic review has found several research gaps which ought to be taken into consideration in future studies. Firstly, there is a large number of studies examining adherence to GFD on celiac patients, but there is substantially less research on non-celiac participants who also follow the diet voluntarily, and even less comparing both populations. This lack of research is of high importance given the fact that GF products have been found to have low nutritional value,

especially because of the high quantity of fats they are comprised of, often with the aim of improving taste, especially GF bread. Thus, following a GFD without need might become a threat to the health of non-celiac followers if this means relying upon highly refined and processed GF food products, which are designed to create a tasty alternative to traditional food products usually based on wheat or other cereals containing gluten. Of course, this should also be of importance to firms that that on their side must carefully consider the nutritional content of GF products and how they are marketed and labelled, should they decide to enter into the GF market.

Secondly, one of the objectives of the current review was to emphasise the differences, which exists between celiac and non-celiac followers of the GFD. However, due to the limited number of studies that have directly compared both groups, it was not possible to give firm conclusions regarding what the critical differences are between these populations. Thus, more research is needed to understand the fundamental differences and what consequences they entail regarding the adherence to a GFD. A richer understanding of this kind could help to target each of these populations in more nuanced ways to ensure that both benefit from GF products targeted to their needs and preferences.

Finally, since the GF market has been expanding rapidly over several years, many food companies are directing their production towards GF products. Hence, it is important to guide them towards a path that is sensitive to different types of consumer motivations and needs. Moreover, this review has shown that research regarding economic factors is limited, and so is currently insufficient to give proper directions regarding the influence of various factors on the pricing of GF products. We found only three articles that have studied WTP for GF products. Furthermore, future research should carefully consider the appropriate methodological techniques to use when studying attributes and WTP for GF products.

In conclusion, regardless of population (celiac, non-celiac), rates of adherence to GFD has increased over time. However, transgression rates in continuing the adoption of a GFD is higher in younger populations, which is of particular concern for those that are required to follow this diet out of necessity because they are diagnosed with CD. Depression, anxiety and QOL are among factors that have been shown to be affected by adherence to a GFD; for instance, comparisons between celiac and non-celiac shows that depression and anxiety are lower for non-celiac followers of a GFD. Nonetheless, due to the limited number of studies that compare celiac and

non-celiac individuals, generalisations from the reported findings should be considered with caution.

In summary, the main areas where research can be considered insufficient and that requires further attention are related to:

- The behaviour of non-celiac consumers following the diet;
- The comparison of the profiles of celiac and non-celiac followers of the diet and the reasons why non-celiac people follow the diet;
- The characteristics of GF products and their relative importance, in order to direct food companies and all relevant actors operating in the GF sector.

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Chapter 3

Celiac and Non-Celiac Consumers' Experiences When Purchasing Gluten-Free Products in Italy[4]

Abstract

Recently gluten-free products are becoming very popular among consumers. Gluten-free market is expanding rapidly due to the increasing number of people affected by celiac disease, but moreover non-celiac consumers are embracing the gluten-free diet. Given these advancements, it is necessary to understand the reasons and beliefs behind food choices made by non-celiac consumers and compare their choices to celiac patients. The current research is very limited, hence further research is needed to generalize and better understand the relation gluten-free-non-celiac consumers and comparisons. Thus, this research aims to give an overview of the gluten-free sector by taking into account perceptions of consumers, retailers and institutional actors. In order to fulfill this objective semi structured interviews were undertaken with consumers and retailers in Bologna, Italy. Furthermore, representative of Celiac Association was also included in this qualitative study. The results showed that most of the concerns regarding gluten free products are related to their low sensorial performance, high prices and low nutritional values. Moreover, it was seen that sometimes non-celiac consumers lack knowledge about gluten free food and diet, believing some myths which are not scientifically proven. Finally, it is necessary that future research focuses mostly on understanding glute-free choices by non–celiac consumers and ways to direct them into more healthy food choices.

Key words: gluten-free, functional food, willingness to pay, purchase, non-celiac

3.1 Introduction

Gluten-free (GF) in the recent years has become a well-known concept in food marketing. A search of the word "gluten" on Google gives 315 million results while the search for "aflatoxin" gives

[4] This chapter largely draws from Xhakollari, Vilma; Canavari, Maurizio, Celiac and non-celiac consumer's experiences when purchasing gluten-free products in Italy, ECONOMIA AGRO-ALIMENTARE, in corso di stampa, 21, pp. 1 – 15.

around 2 million results. Hence, it is necessary to understand what gluten is and why everyone is talking about and searching for it.

According to many sources, the GF market is expanding rapidly in the recent years (Angus & Westbrook 2018; Terazono, 2017; Nielsen, 2015). Thus, it is necessary to understand which the main factors are affecting this expansion.

Gluten-free diet (GFD) is considered very important for people affected by celiac disease (CD) since it is the only proven effective treatment for it. However, other people are following GFD for other reasons than CD. Furthermore, since the market for these products is increasing, probably many other food companies might enter the market. Hence, it is important to discern consumers' needs for GF products and give the necessary directions to the firms that enter the market. Furthermore, it is necessary to understand the factors that drive non-celiac consumers to buy GF products.

Hence, this study aims to shed light about concerns regarding GF products by considering perceptions of consumers, retailers and institutional actors.

To accomplish this goal, an exploratory approach was adopted by performing a qualitative study based on semi-structured interviews administered with consumers, retailers, and the Italian Celiac Association (ICA), trying to explore the main reasons consumers purchase GF products, the attributes they appreciate the most, and their opinion about the future of GF products.

Generally, the GF research has focused mainly on understanding the factors affecting adherence to GFD by celiac people and ways to improve the sensorial experience from part of the celiac consumers. To the best of our knowledge there are only three studies which have analyzed consumers' preferences for GF products. They studied how taste and information affect the willingness to pay (WTP) and intention to buy GF products from part of non-celiac consumers (De-Magistris et al., 2015; de Magistris et al., 2017, 2015). These studies revealed that the WTP for the conventional products was statistically higher compared to GF products and conventional products were perceived by non-celiac consumers to have better sensory proprieties compared to GF products. Furthermore, they found that label and taste did not significantly influence the non-celiac consumers' WTP (De-Magistris, Xhakollari, De, & Rios, 2015; de Magistris, Belarbi, & Hellali, 2017; de Magistris, Xhakollari, & Munoz, 2015).

Thus, considering what have been reported so far, one of the contributions of this study is to give an overview of celiac and non-celiac consumers' preferences about GF products, pasta and bread in Italy. This is of a great interest since Italy is one of the most important contributors of the annual growth rate of GF products (Angus & Westbrook, 2018). Moreover, discerning differences between celiac and non-celiac consumers is another important contribution, especially for the firms which are already in the GF market or are planning to enter. Finally, results from this study might be helpful for future research on consumers' preferences for GF products.

The rest of the article is organised as follow: Background, introduces some information regarding gluten, GF products and the GFD; Methodology, explains the approach applied to achieve the objectives of this study, participants and structure of the interviews; Results are organized in line with the group of participants and present the exact declarations from the participants; Finally, conclusions present a summary of the most important results of the study and some directions for future research.

3.2 Background

Cereals like wheat, barley, rye, and triticale contain gluten, which is a complex of proteins composed of "gliadins" and "glutenins". Gluten is formed when wheat flour is mixed with a liquid and physically shaped, to mention bread kneading (Skerritt & Hill, 1991). However, in genetically predisposed individuals this protein does not get digested causing the so-called autoimmune disorder CD (Dickey, 2009). Symptoms of CD vary from person to person but typically includes diarrhoea, weight loss, anaemia, fatigue, depression and osteoporosis (Haines et al., 2008; Scherf et al., 2016). Intestinal damage accompanies CD, and intraepithelial lymphocytosis, crypt hyperplasia and villous atrophy characterise it (Marsh, 1992). Diagnose can be difficult because the signs and symptoms are similar to other conditions, but with blood tests and a small intestine biopsy, it is possible to distinguish if a patient is suffering CD (Green, 2005).

To date, the only scientifically proven treatment for the CD is a lifelong GFD that is complete avoidance of wheat, rye, barley and other gluten-containing grains. Within the first weeks of GFD adoption, 70% of the patient diagnosed with CD declared improvements in the symptoms of the disease (Green et al., 2001). Thus, considering the importance of this diet, it is necessary to identify the food products allowed.

GF products are usually split into two groups:

1) foods naturally free of gluten that is, GF products that naturally do not contain gluten such as fresh meat, fruits and vegetables, honey, etc.;

2) dietetic (processed) gluten-free foodstuff that is, products that are manufactured using GF ingredients like cereals, principally corn and rice, in substitution of the regular gluten-containing ingredients.

Nevertheless, during harvest, handling, transportation and milling these products/ingredients might get contaminated by other raw materials containing gluten. Hence, to avoid problems and assure consumers' health, the European Commission established the Regulation (EC) No. 41/2009 concerning the composition and labelling of foodstuffs suitable for people intolerant to gluten that states that (Article 3):

"Foodstuffs for people intolerant to gluten, consisting of or containing one or more ingredients made from wheat, rye, barley, oats or their crossbred varieties which have been specially processed to reduce gluten, shall not contain a level of gluten exceeding 100 mg/kg in the food as sold to the final consumer. "

"Products may bear the term 'gluten-free' if the gluten content does not exceed 20 mg/kg in the food as sold to the final consumer."

In line with the EU regulation, in Italy, the Ministry of Health provides with the quality label all products containing less than 20 mg/kg of gluten. Meanwhile, these products must be listed as well in the National Register of products for particular nutritional uses. However, by the end of the 1990s, before the label of the ministry, The Italian Celiac Association (ICA) launched the so-called Crossed Grain symbol, which assured celiac patients about the absence of gluten. Both labels are still operating in the market, and they apply the regulation No. 41/2009.

However, even though GF products might be considered as healthy, some studies have reported that when compared to conventional products they have low nutritional value (Missbach et al., 2015b; Pellegrini & Agostoni, 2015; Wild et al., 2010; Wu et al., 2015) reduced sensorial characteristics (Arendt & Dal Bello, 2008; Arendt et al., 2002; do Nascimento, Medeiros Rataichesck Fiates, et al., 2014), limited availability (do Nascimento, Medeiros Rataichesck Fiates, et al., 2014; Ferster et al., 2015; J. Singh & Whelan, 2011), and high prices (Missbach et al., 2015b;

J. Singh & Whelan, 2011). However, in Italy people diagnosed with CD receive, in accordance with their age and gender, monthly brochure discounts, which, as we will show afterwards, are of a very important support for celiac patients (Servizio Sanitario Regionale Emilia Romagna, 2018)

Furthermore, the gluten-free retail market is forecasted to reach $4.7billion by 2020 (Terazono, 2017). These trends follow the increasing number of people following GFD. Worldwide, 1 -2% of the population is considered to suffer CD (Green & Cellier, 2007; Leffler & Schuppan, 2010), but the true percentage is still believed to be higher since diagnosis is not always easy. For example, in 2016, the celiac population in Italy was counting 198,427 individuals, but it has been estimated that it might reach to 407 467 people (De Stefano & Silano, 2016).

Table 3-1 Estimations of the prevalence of CD worldwide

In the general population	**1 in 133**
Symptomatic children	1 in 322
Symptomatic adults	1 in 105
In first-degree relatives of people with CD	1 in 22
In second-degree relatives of people with CD:	1 in 39
In chronic disease (such as type 1 diabetes):	1 in 60
In African, Hispanic and Asian-Americans:	1 in 236
World-wide prevalence:	1 in 266

Moreover, the Italian annual report on the CD revealed that regions with the most substantial number of celiac people are Lombardy (17.7%), Lazio and Campania (9.7%); the majority of celiac people are women (70% of the celiac population), and regarding "Age", the report suggests that CD prevails mostly among age group older than 10 years old and it is least prevalent among infants up to 6 months.

However, it is necessary to mention the fact that in the recent years not only people suffering from CD are following the GFD. In Italy, about 6 million non-celiac consumers follow a GFD. According to Associazione Italiana Celiachia (2017) they spend around 105 million Euros per year on GF products. However, it is important to understand these increasing trends. Non-celiac consumers are often affected by non-celiac celebrities who consider the GFD to stay in shape as well as to increase energy level, like the famous tennis player Novak Djokovic, who reported how the GFD improved his life in his book "Serve to Win" in 2013. Thus, non-celiac consumers should also be taken into account when studying GFD and GF products.

Considering the above facts, the increasing number of people following a GFD have induced the demand for GF products. US, Italy and the UK are the most important contributors of this growth (Angus & Westbrook, 2018). Thus, when trying to shed light on the increasing phenomenon of "gluten" the food industry of "free from gluten", producers, retailers and other stakeholders, are necessary to considered.

Thus, this study addresses the following issues:

- Find out the supply for GF products and other services provided by retailers
- Understand consumers' satisfaction with GF products
- Figure out perceptions of consumers, retailers and institutional actors about the future of GF products and GFD

In order to achieve these aims, the present study have approached retailers, in order to understand supply for GF products; consumers, celiac and non-celiac, in order to understand their experience when purchasing and consuming GF products; and representative of ICA in order to learn about the past problematics of the GF products and point out some future perspectives of this category of food.

3.3 Data and methods

We adopted an exploratory approach through semi-structured interviews to attain the objectives of the study. Participants were divided into three groups: 1) Consumers, celiac and non-celiac subjects; 2) Retailers and 3) Representative from ICA. Each group was interviewed with a different set of questions. However, all the participants in the study, were asked about the GF products' characteristics they appreciate the most and their main concerns.

Participants were recruited through the support of the ICA, Emilia Romagna office, through visits to the specialised stores in the city and social media. All participants live in the Emilia-Romagna region and follow the GFD. Regarding the retailers, the interview was conducted with the salesperson of one specialized shop, brand manager of a well-known supermarket and a pharmacist. They all were located in the city of Bologna, Italy. Finally, a representative from ICA, Emilia-Romagna's office participated in the current study.

Data were obtained through semi-structured interviews. Interviews lasted 30 – 40 minutes and were audio recorded. Participants were asked to give consent for the recording. Table 3-2 represents the structure of the interviews for each group of interviewees.

Table 3-2 Structure of the interviews

Participant	Interview Structure
Representative of the Italian Celiac Association (1 representative)	General description of the participant and his/her role in the association
	Description of the association, partners and the services provided for the members
	Non-celiac members and their role in the association
	Concerns about GF PRODUCTS and improvements obtained during the years
Retailers (3 subjects)	General description of the participant and why he/she got engaged in the gluten-free sector
	Characteristics of the most and least demanded GF PRODUCTS. GF PRODUCTS attributes for which consumers are more concerned and mostly prefer. The future of GF market.
	Characteristics of non-celiac clients
	Collaboration with Italian Association of Celiacs
Consumers (10 subjects)	Type of the diet they follow and why they decided to embrace the GFD
	Questions regarding characteristics of bread and snacks (in general)
	Compare GF and conventional bread and snacks.
	Purchase experience (GF PRODUCTS)
	Socio-demographic questions

Immediately after each interview, the interviewer listened the recording and wrote a summary report. Information from the summary reports, together with available transcription and comments were analysed. We used a content summarising procedure, aimed at describing the phenomenon and at presenting the most interesting elements arising from each interview, to gain an extensive overview of informants' attitudes toward the topic. Verbatim quotes of respondents were used to exemplify the results.

3.4 Results

3.4.1 Italian Celiac Association (ICA)

We interviewed the secretary of the Emilia-Romagna's office. Her role is related to the communication of initiatives undertaken by the association and support to the members.

Approximately, ICA has 6 thousand members. One of the main services provided by the association is the so-called "Front office". This service is offered mainly to the new members. ICA's volunteers inform the new members about the disease, the diet and other issues, which are of relevance to them.

ICA organises other events and manifestations aiming to inform about the symptoms and diagnosis of the disease, and about the GFD. Other projects currently operating are the following: "Front office – Nutritionist – Psychologist"; "Eating outside"; "The school project". Furthermore, ICA supports members during the food purchase through an app that contains information about the permitted GF products.

The representative declared that the focus of ICA is celiac members. However, everyone might become a member of the association.

Regarding the adoption of a GFD, she declared that a GFD should be followed only by non-celiac patients.

*"We deliberately believe that GFD should be followed only by non-celiac patients. We have noticed that in the recent years, non-celiac people are following the diet, due to media, especially on the Internet, which are considering GFD as healthy and enhancer of people's life."***(ICA representative, Emilia-Romagna Office)**

The association offers support to all the members focusing on the GFD and the CD, while it does not offer specific support to non-celiac people.

Regarding some of the most important attributes of the GF products, the ICA representative mentioned taste and nutritional aspects.

"*Taste is very important when choosing the product. Recently, the nutritional factors are becoming a serious concern for the members, and AIC is working to improve this concern."* **(ICA representative, Emilia-Romagna Office)**

Regarding brand, in Italy, the GF companies with the highest market share are Dr Schar, Malgara Chiari & Forti SpA and Danone (Euromonitor, 2016). However, the perception of the association was:

"*Most preferred brand for example for pasta is Mulino Diveti. The leaders are DrSchär and Nutrifree*." **(ICA representative, Emilia-Romagna Office)**

She declared that bread is one of the products for which members of the association have most reserves, due to reduced sensorial characteristics. However, the situation recently improved since members can find fresh artisanal bread.

The representative of ICA declared that, in the recent years, choices for followers of GFD have increased. According to her, while in earlier times only pharmacies were offering GF products, nowadays they are present in the supermarkets, and also many specialised stores are operating in the market. Moreover, in the recent years, the association has noticed improvements regarding sensorial characteristics of GF products, due to the higher number of companies entering the market. She also declared that many restaurants are offering GF menus, thus improving the social life for followers of GFD. However, prices are still high, though purchasing at the supermarket is much cheaper if compared to pharmacies and other specialised outlets.

3.4.2 Retailers

All the retailers are located in the city of Bologna, Italy. However, the supermarket is operating in many regions of Italy.

The specialized shop is operating since 2013 and it provides a wide range of GF products, from pasta to all the bakery stuff. It also offers frozen GF products. Recently, cosmetic GF products have been introduced to the shop.

The supermarket started to sell GF products in the first years of 2000. Now it offers a wide range of GF food and it has also developed its own GF brand.

The pharmacy has been selling GF products for more than 20 years. They offer mainly packaged food, like bread, pasta and snacks. However, the pharmacist declared that in the recent years consumers are switching their purchases of GF products to specialized shops and supermarkets.

Regarding food products, the main suppliers are Dr Schär, Nutri Free, Piaceri Mediterranei and Viaglut.

Pizza and bread are the most demanded product categories, while rice frequently substitutes pasta. On the other hand, snacks are the least requested, in his opinion probably because of their poor ingredients and a high content of fats. Consumers substitute them with other types of hunger-breakers such as fruits. However, snacks are mostly consumed by kids, especially during snack time at school.

Regarding characteristics of GF products, consumers are mostly concerned about the type of fats, especially palm oil, butter, and other saturated fats. However, the pharmacist and the representative of the supermarket declared that taste and texture need to be taken into account by the firms.

"*For sweets, they complain about fat contains (palm oil, butter, saturated fat). For bread, they complain more about fats (palm and colza oil). Only for the nutritional content of the product. We haven't received any complaint about the taste, price or texture.*" **(Retailer in Bologna)**

"I think characteristics such as taste and texture are the ones that should be improved. I cant say the taste of GF products is less good than the conventional, but I think it is different. Consumers' are not used with that". **(Supermarket in Bologna)**

Concerning attributes perceived as most relevant to the consumer, consumers highly appreciate a more natural and less processed product. Furthermore, food packages like conventional counterpart and the seal of ICA are also important attributes to consumers when purchasing GF products. Regarding claim and brand, the retailer declared that:

"*Crossed Grain is the most preferred. What I think is more a psychological factor since it has been one of the first claims operating in the market. Regarding brand, Dr. Schär is the most demanded and reliable.* **(Retailer in Bologna)**

"*Our supermarket's brand, for GF products, has adopted the crossed grain label of AIC. We have conducted a study and our clients recognized this label".* **(Supermarket in Bologna)**

The retailers were also asked about the non-celiac consumer's group age and reasons why this category followed a GFD.

"*Non-celiac category consumers in our shop belongs to the age group 30-40 years old. I think that the consumption of GF products by part of the non-celiac consumers is a fashion and is temporary. Recently, many non-celiac consumers are buying this category in our shop. If I was not suffering from CD, I would not choose to buy GF products since their nutritional properties are not healthy. I think they are not well informed about food.*" **(Retailer in Bologna)**

3.4.3 Consumers

We recruited consumers in collaboration with the IAC Emilia-Romagna, through intercepting them at local stores and on social media. In total 7 interviews were conducted with non-celiac consumers (6 females and 1 male) and 5 interviews with celiac patients (4 females and 1 male).

The age range for non-celiac consumers was from the late 20s to early 50s and for celiac patients from early 20s to early 60s.

The non-celiac consumers follow the GFD for different reasons. Two of them declared to follow the GFD with no medical prescription, one was suggested by the doctor because of dermatitis, and four other participants were parents of a celiac person and were partly following the GFD. They do not suffer from any symptoms related to CD but voluntarily started to follow the diet. They declared to feel improvements in their digestive system since the moment they started to avoid gluten.

"*I do not suffer from CD. I discovered gluten-free diet during a trip, and I started to follow the diet voluntarily. Since then my intestine problems have disappeared, and I have lost weight.* "(**Male, 55 years old, non-celiac person**)

"*I started to follow the diet because my mom had some health problems and the doctor prescribed her to follow the GFD. I also lost weight when I started to follow the GFD. I think the GFD is good for me since I am allergic to nickel and the pollen of Gramineae. One of my relatives is a doctor, and she says that excessive intake of gluten might cause cancer*." (**Female 28 years old, non-celiac person**).

Another person started to follow the GFD after medical prescription due to dermatitis, and four were parents of celiac patients, and they partly follow the GFD.

*"I had skin problems, and my doctor suggested me to avoid gluten. Since I stopped eating gluten, my skin problems disappeared. I follow the GFD in the past 2 years. I eat products naturally gluten-free. However, sometimes, I buy GF bread" (***Female, 38 years old, non-celiac***)*

"*My son suffers from CD for 2 years. I follow GFD only at home*." (**Female, 48 years old, mother of celiac person**)

One of the objectives of the study was to understand consumers' experiences during the purchase of the GF products. The analysis has focused on two products, bread and pasta.

All the celiac and non-celiac participants agreed with the fact that GF bread is still one of the least satisfactory products when it comes to sensorial characteristics in the comparison with a regular product.

"*GF bread is less tasty, and the texture is not good. I do not like the colour, which is very white for my taste. I try to choose other substitutes for bread such as crackers, piadine, tigelle*" (**Male, 55 years old, non-celiac person**)

"Hard to find a processed bread which fits your tastes. That's why I choose to prepare bread on my own. A positive experience is that the processed GF bread can be stored for longer periods." (**Female, 47 years old, mother of celiac person**)

"*I prefer bread with a crispy crust and soft inside. However, GF bread is not very good. Generally, the inside part of the bread and the crust are equally soft. However, ready sliced bread when warmed up, it improves the taste and the texture. Nonetheless, you can't preserve it for a long time.*" (**Female, 30 years old, celiac person, following the diet for 16 years**)

The situation with pasta was different. In general, it is considered good and not very different from the conventional pasta.

"*I have not found big differences with the conventional pasta. I don't like pasta made from rice and legumes flour, mainly because of the colour. I prefer the corn pasta. However, it is better to eat pasta right after you cook it. Otherwise, the texture and taste change a lot when it gets cool."* (**Female, 38 years old, celiac person, following the diet for 10 years**)

"There are some types of pasta for which I don't see differences with the conventional ones. They are mainly prepared with naturally GF cereals, like quinoa. However, the pasta made with rice and corn are different from the conventional, regarding colour and taste. Nonetheless, I think pasta is good." (**Female, 32 years old, mother of celiac person**)

Regarding non-sensorial characteristics, all the participants of the study raised concerns regarding nutritional values of GF products in general and bread in particular. Price is another concern, considered high by most of the participants. However, for celiac consumers who can benefit of the "voucher" from the Italian Ministry of Health, this problem is easily managed.

Other important attributes when purchasing food products were brand, GF claims and packaging. In general, consumers who follow GFD do not have only one favourite brand. For different products, they buy different brands. However, Dr. Schar and Nutrifree brands have been mentioned by most of the participants. Regarding GF claims, participants prefer mostly the claim "gluten-free" and recognise the "cross-grained seal" of the ICA. Nonetheless, only two of the participants recognised the "gluten-free" label from the Ministry of Health.

"*In the beginning, I was eating more processed foods compared to what I eat now. However, I got tired of the taste; it is a very sweet taste and heavy in fats. However, my concern is more related to taste than nutritional values. Now, for example, I eat products that naturally do not have gluten. For example, I prefer a slice of bread with Nutella. Also, my wife prepares biscuits and sweet bakery at home. Prices are high, but with the "voucher" it is easy, I don't finish all the monthly amount we are provided with. Regarding the claim, I always try to find the writing "gluten-free".*" (**Male, 48 years old, celiac person, following the diet for 12 years**)

"*I have some favourite brands. But for different products, we have different brands. I use Dr Schar for the bread or I prepare it with the flour Nutrifree. I generally do the grocery at Ipercoop. Some flours I buy at specialised stores. Prices are higher, it is almost double the price, and for flours, it is 7 times more expensive. We have the "voucher", but without them, it would have been very difficult. I don't read the ingredients, but I have read that the snacks have a high percentage of saturated fats. I don't consume them, and my daughter does not eat them often. I think flours are healthier. Hence I try to prepare sweet bakery, biscuits and other crackers at home."* (**Female, 34 years old, non-celiac person, mother of a celiac person**)

"*I try to buy pasta which does not have a high list of ingredients. Ingredients for bread are very complex, and sometimes I don't understand them. However, I don't consume bread frequently. I eat Dr Schar bread for example. However, I am always open to new brands; I am very curious.*

My family also eats gluten-free. In general, I think GF products have a high price, but I have the "voucher" of the Ministry, so for me, it is not very important. The claim for me it is not very important. In the beginning, I was always referring to the list of the ICA. I always check the list of ingredients and even if I don't find a claim I am ok with that." (**Female, 38 years old, celiac person, following the diet for 10 years**)

Following the GFD is also a life-changing experience, especially for celiac consumers. While non-celiac people, voluntarily following the diet, declare improvements of their life especially physical shape, celiac people declare that the relation with food changes dramatically. However, they try to manage it especially when eating outside by electing restaurants which offer a gluten-free menu or sometimes by having with them something to eat.

"*After you are diagnosed with CD, life changes. There is a very important issue here, the relation with the food should not be stressful, and one should feel relaxed when eating. However, this is not the case for a celiac person. It is very important to be careful since what we are served in the plate might be dangerous. If I had the chance, I would choose not to be celiac person. I have discovered to suffer from CD in mature age, and I have not felt the social isolation, but I think for the teenagers is a serious problem*." (**Male, 48 years old, celiac person, following the diet for 12 years**)

"*I don't feel my life has changed a lot since the moment I discovered to suffer from CD. However, sometimes I don't go out for example at a pizzeria, or I always try to bring something with me."* (**Female, 24 years old, celiac person, following the diet for 3 months**)

"*My life has changed positively, I have achieved the weight I have always wanted to reach, and I don't have the intestinal problems I used to have before starting the GFD.*" (**Male, 55 years old, non-celiac person**)

"*It is very hard to eat outside. However, I try to get more information about what restaurants offer, and the reviews. Sometimes restaurants even though are certified by ICA; they offer contaminated food. I trust more the reviews from other people.*" (**Female, 61 years old, celiac person, following the diet for 3 years**)

Regarding the reason why non-celiac people follow the GFD, most of the participants considered them as not having the right knowledge about the diet and its side effects and being affected by the celebrities. However, two of the participants who were voluntarily following the diet considered it as healthier:

"*Why a person should not follow the GFD? As long he/she feels better I think there is nothing wrong about it. Moreover, one of my relatives, who is a doctor, told me that excessive intake of gluten might cause cancer.*" (**Female, 28 years old, non-celiac person, following GFD voluntarily**)

"*I think many non-celiac consumers are not well informed about the ingredients found in processed gluten-free products. After the 40s it is recommended to lower the level of gluten in the diet. Many people know this, but on the other hand, they do not know the side effects of the ingredients found in processed gluten-free products. I would recommend a diet which is naturally gluten-free. Moreover, another factor might be*

the presence of a family member with celiac disease, as in my case." (**Female, 48 years old, mother of celiac person**)

"*I think the new varieties of grain have a higher quantity of gluten compared to the old grains. This might be a reason for the increment of CD and other intolerances to gluten. However, people who do not have any health problem but voluntarily follow the GFD cause confusion among the public opinion. For example, they go to a restaurant and pretend to follow the GFD but then eat conventional products. If I go to the same restaurant, the owner won't take my illness seriously, and I might get offered food which is harmful to my health. I don't understand them; I would prefer not to have the CD*." (**Male, 48 years old, celiac person, following the diet for 12 years**)

"*Maybe, because Gwyneth Paltrow says it is good for your health? I think that non-celiac people following the GFD should not to give wrong information. However, I don't understand why they follow the diet since to date no study has proved that the GFD is healthier than the normal diet. I think it is fashion. However, I don't think they have affected the increase in the supply. Recently a lot of people are being diagnosed with CD and I think this is the main reason why everyone is talking about this diet and the market is expanding."* (**Female, 30 years old, celiac person, following the diet for 16 years**)

3.5 Discussion

The current qualitative study, through semi-structured interviews, aimed to give some further insights into the perception of GF products in Bologna. Interviews were carried out with a representative of ICA, three retailers and consumers, celiac and non-celiac people.

The first objective of this study is to understand the general supply for GF products in the region. According to our results, in general, the range of GF products has increased in the recent years. This was confirmed by most of the participants in the study. GF products are found now almost everywhere, supermarkets, specialized stores and pharmacies. However, consumers raised some concerns about the catering services, which sometimes, due to limited knowledge about the CD and the GFD, fail to provide non-contaminated food.

Furthermore, the present study aims to learn the perceptions about the GF products and what consumers experience when buying and consuming this typology of product.

The non-celiac consumers we interviewed agreed that GF products have worse sensorial properties and higher prices. They did not consider the nutritional properties of GF products and acknowledged that GFD improved their health and helped them in pursuing weight loss.

On the other hand, family members of celiac people and celiac consumers presented the nutritional values as one of the main concerns they had. They also acknowledged that sensorial characteristics of GF products and the availability have improved in the recent years. However, according to them, a lot needs to be done regarding these attributes. Especially for bread, which emerged as the least preferred product regarding sensorial and nutritional attributes for both celiac and non-celiac consumers. On the contrary, pasta is considered as having better attributes and was not considered as very different to the conventional one regarding nutritional and sensorial perspectives by all the consumers of this study.

Both celiac and non-celiac consumers considered prices of GF products as very high, especially for flours, where sometimes the price is 7 times higher if compared to the conventional. However, for celiac participants, the “vouchers” they receive from the Ministry are enough to lower the importance of price. This was also confirmed by the retailers, which have not received any complaint about it from part of the consumers. However, not all the shops accept the “vouchers”.

The brand is another important attribute which emerged during the interviews. It was noticed that consumers did not have one specific favourite brand, but they categorise them regarding specific products. Nevertheless, Dr Schar was mentioned by most of the consumers, retailers and ICA.

ICA focuses its activities on celiac members. According to their representative, in the recent years, GF products have improved dramatically in terms of availability, taste and price compared to ten years ago. However, the nutritional value of these products remains an important issue. In line with this, the representative of the specialized shop confirmed that nutritional value is a permanent concern among celiac patients. Furthermore, ICA believes that GFD should be followed by celiac people and the phenomenon of non-celiac people following a strict GFD is seen as a fashion, amplified especially by reports and discussions spread on social media. In line with this, the retailers believe that non-celiac people following GFD are not well informed about the nutritional content of GF products and that they have a false belief that this diet helps them to lose weight. Moreover, they see this as a temporary trend.

Finally, following GFD is a life-changing experience. The non-celiac participants who voluntarily follow the diet declared that their life improved drastically. However, the situation is different for celiac participants, which in most of the cases declared that they would not choose to suffer the disease and consequently not following GFD.

Regarding the question of the reasons why non-celiac people should follow the diet, the non-celiac participants suggested that everyone should follow the GFD and sometimes gluten might cause cancer. Contrary, celiac consumers, family members, retailers and ICA, considered these trends as a fashion and as temporary. Moreover, they see this group of people as not well informed, which sometimes might create confusion regarding the CD and the GFD. Table3-3 shows some of the most important notions that emerged during the interviews.

Since the research regarding adherence to GFD and acceptance of GFP by non-celiac consumers is very low, this study contributed to strengthening the previous finding that the main concerns about GF products are related to the sensorial experience and price (Grunert et al., 2000; Olsson et al., 2008; Urala & Lähteenmäki, 2003). However, concerns regarding nutritional value and the level of information from part of non-celiac consumers following GFD emerged. These elements were not taken into consideration in the studies mentioned at the beginning of this paragraph. Hence, it is necessary for future research to focus on the understanding of consumers' choices and how these choices might be shaped when provided with the necessary information regarding nutritional values of the food products they purchase. This understanding will contribute to helping consumers to make healthier and better food choices. I addition, future research should also consider factors which affect adherence to GFD, since as it was observed in the study, non-celiac consumers do not have all the adequate information about the diet and the nutritional values of GF products.

Moreover, future research should take into account the necessities of GF industry, in order to support them in producing food products which respond to consumers' needs and preferences.

Table 3-3 Summary of the most important notions about the GF products and diet

		ICA	Retailer	Consumers		
				Non-celiac	Celiac's family member	Celiac
Gluten-free products	**Price**	High			High but we have the vouchers	
	Availability	Good	High	On average	Good	
	Nutritional values	Low		Did not mention them as relevant	Low	
	Sensorial characteristics	Bread low/ Pasta good				
	Brand	DrSchär/Nutrifree/ Mullino Divieti	Dr Schär/Nutri Free/Piaceri Mediterranei/Viaglu t	Depends on the product but Dr. Schar/ Nutrifree most important		
	Non-celiac following the gluten-free diet	Fashion	Fashion/Limited knowledge	It is healthy, gluten might cause cancer	Fashion/Limited knowledge/Creating confusion about the disease	

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Chapter 4

Explaining Adherence to the Gluten-Free Diet for Celiac and Non-Celiac People[5]

Abstract

Gluten-free diet (GFD) is the only proven treatment for celiac disease. However, recently non-celiac people are starting to follow the diet due to other disease, which research has found that improve when avoiding gluten; family members of celiac-patients who follow the diet at home in order to avoid food contamination and non-celiac people who voluntarily follow the diet because they think that it improves their health. Nevertheless, to date research has not found that GFD should be followed by people who do not have any health issue. Furthermore, research has found that gluten-free (GF) products, generally, have a lower performance on nutritional aspects when comparing to their conventional counterparts. Thus the main aim of this research is to understand factors affecting adherence to GFD by celiac and non-celiac people and discern if economic aspects play any role in the adherence. In order to achieve this objectives, adherence to GFD was modelled by considering constructs of multi theory model (MTM) and integrative model (IM). Moreover, a contingent valuation (CV) was applied with non-celiac participants, following and not following GFD, in order to understand the willingness to pay for a GF product (pasta with teff) and find out the relation between WTP and adherence to GFD. Results show that adherence to GFD is affected mainly by attitudes towards GFD, self-efficacy, injunctive norms, knowledge about GFD and perceptions that GF products are expensive. Furthermore, results show that there is a positive relation between WTP for GF pasta and adherence to GFD meaning that non-celiac people who follow a strict GFD have a higher WTP for the product.

Key words: gluten free diet, multi theory model, integrative model, pasta, willingness to pay.

4.1 Introduction

Gluten-free diet (GFD) excludes the protein gluten, which is found mainly in wheat, rye and barley. To date, GFD is the only treatment for people affected by celiac disease (CD), an autoimmune

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disorder of the small intestine caused by the ingestion of gluten (Trier, 1998). According to Green et al., (2001) within the first weeks of GFD's adoption, 70% of the patient diagnosed with CD declared improvements in the symptoms of the disease. According to DiMatteo (2004), adherence is high in patients suffering from gastrointestinal disorders, around 80%. Moreover, adherence to GFD varies from 30% /50% to strictly followers of the diet (Barratt et al., 2011; Corposanto et al., 2015; Edwards George et al., 2009; Sainsbury & Mullan, 2011; J. A. Silvester et al., 2016). Therefore, following GFD is crucial for the well-being of people affected by the CD. Thus, one of the issues this study investigates is how to improve adherence to GFD by celiac people.

However, apart from celiac patients, in the recent years, non-celiac consumers are also embracing the GFD. To illustrate, according to the Nielsen report on healthy eating, 23% of the participants in the survey avoided gluten (Nielsen, 2015a). Moreover, in Italy approximately 6 million people follow a GFD voluntarily (Associazione Italiana Celiachia, 2017). But why non-celiac people follow the diet? Firstly, family members of celiac people are following GFD in order to avoid food contamination at home and since the disease is consider inherited, the GFD might prevent the appearance to other members (Bogue & Sorenson, 2008). Secondly, GFD has been considered as a treatment option for other conditions, to mention some: dermatitis herpetiformis, anemia, irritable bowel syndrome, rheumatoid arthritis, diabetes mellitus, HIV-associated enteropathy and other neurologic disorders (Bürk et al., 2009; El-Chammas & Danner, 2011; Srihari Mahadev et al., 2013; Samasca et al., 2017). Finally, other people who do not have any specific symptoms are recently following the diet, mainly influenced by non-celiac celebrities who consider the GFD as shape keeper and energy giver (Ranker, 2015). Hence, the second topic in which this research focuses on is to discern factors that drive non-celiac people to follow the diet and the ways to support them in making healthy food choices. This is of a high importance since to date, research has not shown that GFD should be considered as a better diet option for the general population that does not suffer from any specific condition or disease (Gaesser & Angadi, 2012; Marcason, 2011; Niland & Cash, 2018). In line with this, D. Lis, Stellingwerff, Kitic, Ahuja, & Fell, (2015) did not find any effect of the GFD on the overall performance of non-celiac athletes.

However, since the consumption of gluten-free (GF) products is increasing, research continues to investigate the effects of the GFD, especially the nutritional effects of the diet. Studies on celiac patients following GFD have shown that there is a decrease of carbohydrate intake as fibres and an increase as sugars (Babio et al., 2017; Bardella et al., 2000). Furthermore, regarding proteins,

studies have found that GF products have a lower percentage of proteins compared to their counterparts (Estévez et al., 2016; Tricia Thompson et al., 2005). However, other studies have shown that the protein intake among GFD followers still meets the nutritional targets (Shepherd & Gibson, 2013; Staudacher & Gibson, 2015). Results regarding fat consumption are also contradictory. Some studies demonstrated that the level of fats in a GFD is sometimes twice of the normal levels (Babio et al., 2017; Barone et al., 2016; Miranda et al., 2014). However, research conducted in Australia, showed no differences on the fat content between GF products and their counterparts (Estévez et al., 2016; Wu et al., 2015). Regarding micronutrients, research has shown that GF products have a lower content of Vitamin B group, iron, folate, magnesium (T. Thompson, 1999; Wild et al., 2010), manganese (Hallert et al., 2002) and calcium (Kinsey et al., 2008; Shepherd & Gibson, 2013).

Concerning other aspects of GF products, studies have shown that they are less tasty than conventional foods (Arendt & Dal Bello, 2008; Arendt et al., 2002; do Nascimento, Medeiros Rataichesck Fiates, et al., 2014); are more difficult to find at the grocery shops and/or supermarkets (do Nascimento, Medeiros Rataichesck Fiates, et al., 2014; Ferster et al., 2015; J. Singh & Whelan, 2011) and are expensive (Fry et al., 2018; Missbach et al., 2015b; J. Singh & Whelan, 2011).

Hence, while following GFD is strongly related with the well-being of the people suffering from CD, the reasons why non-celiac people follow a GFD remain unclear. Why people are ready to pay higher prices and engage in a diet which has not been scientifically proven to be healthier than other options? How to improve adherence to GFD by celiac and other people who follow the diet because of health problems? Is there any possibility for non-followers of the diet to engage in the GFD?

Therefore, the main objective of this research is to understand factors mostly affecting adherence to the GFD from both, celiac and non-celiac people.

Moreover, in order to achieve this objective, we have considered results from the second chapter on the “Factors affecting consumers’ adherence to GFD, a systematic review” and we have identified the eight factors affecting adherence to GFD. Health-related behavioural models, Integrative Model (IM) and Multi Theory Model (MTM), will be applied in order to understand the behaviour related to the GFD and discern the model that better explains the behaviour. The

necessary hypotheses will be tested considering both the results of the literature and the theoretical constructs of the health behavior models. The relation between constructs of the models and the adherence to GFD will be empirically tested using ordered logit models.

Finally, since Gf products are considered as expensive, a contingent valuation (CV) method will be applied to non-celiac participants, followers and non-followers of the diet, in order to find out if there is any correlation between WTP for GF products and adherence to GFD.

The rest of the article is organized as follow: Theoretical framework and model constructs section introduces the models applied to this study and the hypotheses of the current study; Methods represent the way experiment was designed, how the data were collected and analysed; Results' section show the main findings of the study and how hypothesis hold; Conclusion represents a discussion of the outcomes of this study and how they might help the general understanding of the behaviour towards GFD.

4.2 Theoretical framework

In the scientific literature, a large number of models have tried to understand people's health behaviour. One of the oldest models is the Health Belief Model (HBM) developed in the 50s. It states that perceptions of illness threat and the evaluation of behaviours to counteract this threat are the cognitions that determines the health behaviour. However, the model has been considered as incomplete by many studies (Carpenter, 2010; Hay, Pawlby, Angold, Harold, & Sharp, 2003; Ogden, 2003; Rosenstock, Stretcher, & Becker, 1988).

Thus, researchers have tried to improve HBM and others have developed new models for predicting and changing health behaviours. Since there was overlapping among these models, Fishbein et al. (2000) constructed a new model, the Integrative Model (IM) of behavioural prediction. As the Theory of Reasoned Action (TRA) and the Theory of Planned Behaviour (TPB), the IM states that intentions are integrative part of the behaviour and a function of attitudes, subjective norms and perceived behaviour control, but in addition to this, the model specifies also that environmental factors, skills and abilities can mediate the intention-behaviour relationship (Figure 4-1). Moreover, IM states that subjective norms are a function of descriptive and injunctive norms.

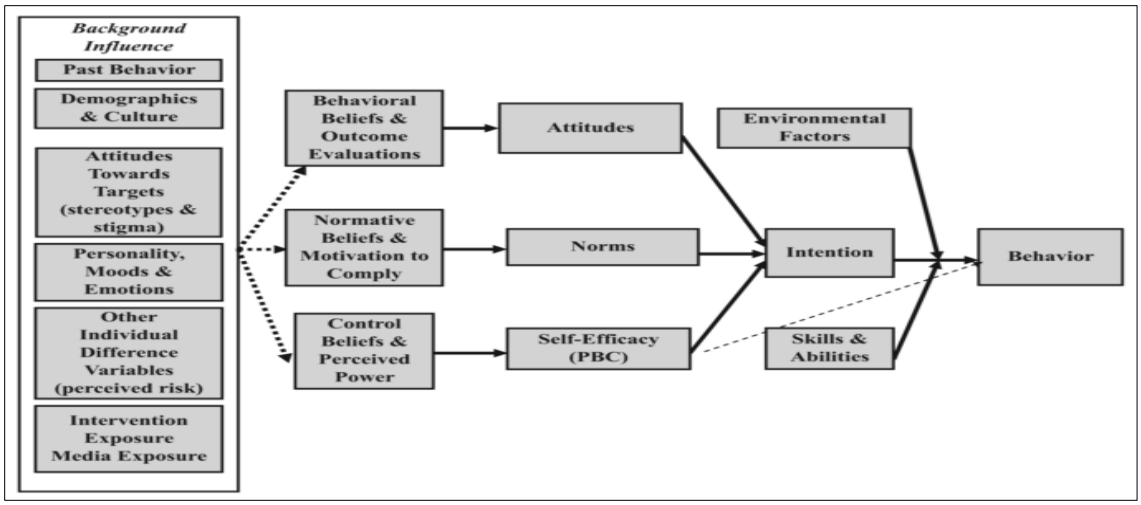

Figure 4-1 Integrative Model (Fishbein 2008)

Another new theory, which attempts to explain the health behaviour, is the Multi-Theory Model (MTM), developed by Sharma in 2015. The model includes empirically tested constructs from previous theories, considers one–time and long–term behaviour changes, is applicable in an individual, group and community level and is culturally viable (Manoj Sharma, 2015). The model considers the behaviour as a function of two moments, first the initiation of the behaviour change (figure 4-2) and second, the continuation of the change (figure 4-3).

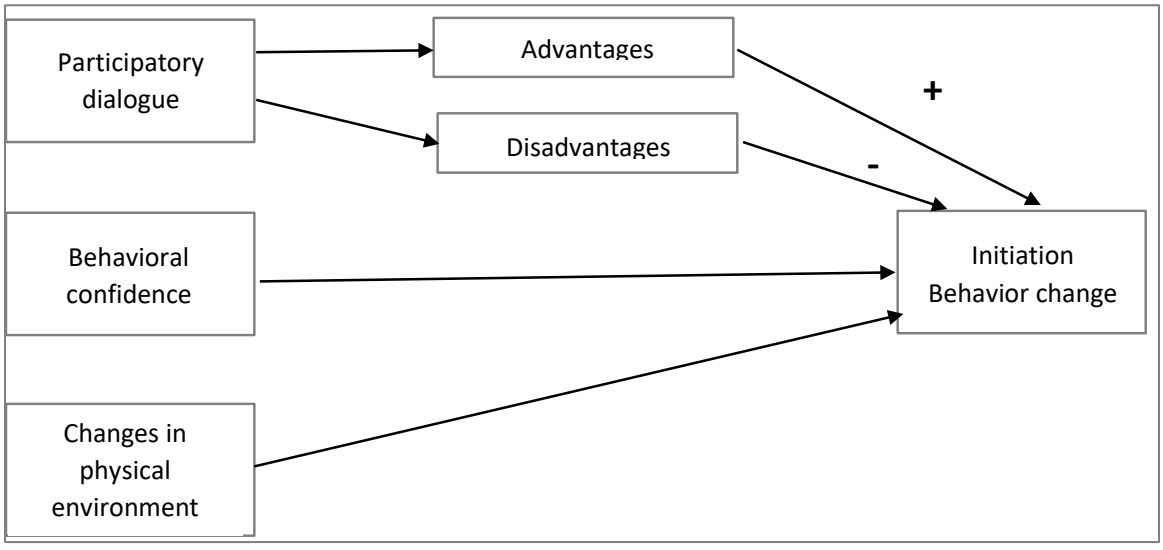

Figure 4-2 Inititation Model, MTM (Sharma 2015)

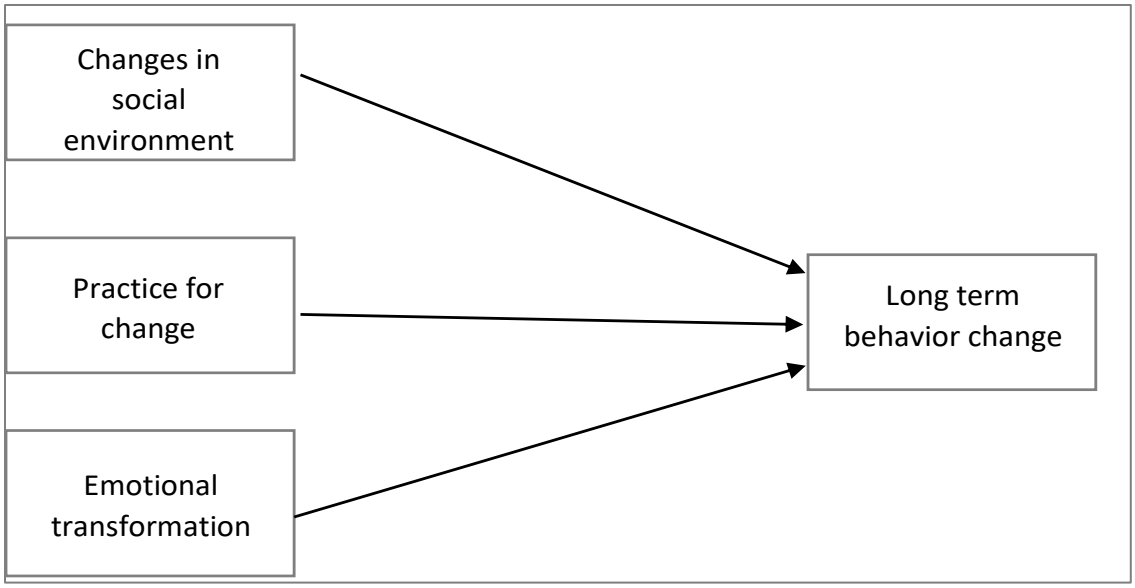

Figure -4-3 Continuation Model, MTM (Sharma 2015)

However, a limited number of studies have applied behavioural models aiming to understand and improve adherence to GFD by celiac patients. Dowd, Jung, Chen, & Beauchamp, (2015) applied the Protection Motivation Theory (PMT) to understand adherence to GFD, accidental and purposeful consumption of gluten, during a 1-month period of time. They found that for purposeful gluten consumption, intentions intervene partially the effects of symptom severity, self-regulatory efficacy, planning and knowledge, but for accidental incidents of gluten they did not mediate the effects of severity, response cost, self-regulatory efficacy, planning and knowledge. However, the authors did not consider the social norms. Moreover, Sainsbury & Mullan (2011); Sainsbury, Mullan, & Sharpe, (2013) and (2015) have applied the TPB to explain adherence to GFD from part of celiac patients. They found that the TPB is a good tool for predicting adherence to GFD. Nevertheless, TPB has limited capacity to change and/or improve the behaviour (adherence to GFD) because it states that intention of an individual to exert certain behaviour is a function of attitudes towards the behaviour, subjective norms and perceived behaviour control but according to Fishbein (2008) intentions do not always predict behaviour and sometimes people do not act according to their intention. It might happen that even though an individual has the right attitude he/she doesn't perform the correct behaviour because other possible factors such as necessary skills and abilities or internal/external barriers prevent them to perform the behaviour (Fishbein, 2008).

However, as it was shown in the beginning of this section, IM and MTM states that they have overcome these barriers of the TPB, but to date they have never been applied to the GFD's adherence.

Meanwhile, as it was mentioned in the previous section, understanding behaviour towards GFD is of a high importance firstly for celiac patients, since GFD is the only treatment for CD, and secondly for non-celiac consumers who voluntarily follow the diet, since to date no research has found that GFD is a healthier option for them. Moreover, comparing both models is of benefit for the researcher in order to evaluate if IM and MTM explain the real behaviour of individuals.

Moreover, to our knowledge, IM has been applied to only one food consumption study (Collado-Rivera, Branscum, Larson, & Gao (2018) while it has largely been applied to other research mainly on sexual behaviour (Buhi et al., 2014) and sleeping issues (Robbins & Niederdeppe, 2015; Tagler, Stanko, & Forbey, 2017). According to Collado-Rivera et al. (2018), the IM is considered as a good model for explaining sugary drink consumption among overweight and obese adults. Nevertheless, IM has not been widely applied to eating behaviour studies.

On the other hand, MTM has been mostly applied for explaining behaviour related to physical activity (Bridges & Sharma, 2017; Manoj Sharma et al., 2016) and smoking (M Sharma, Khubchandan, & Nahar, 2017)(Manoj Sharma, 2017). Two studies apply the MTM to predict and explain the health behaviour related to food (Manoj Sharma et al., 2017, 2016). They suggest that the model is a good tool in explaining and predicting behaviour; however, since it is a new method, it is necessary to broaden the range of behaviours investigated and the sample, which currently is limited to university students and children.

4.3 Models' constructs and hypotheses

In order to bring adherence to GFD in the framework of IM and MTM some adjustments were considered necessary.

Firstly, IM was applied to both celiac and non-celiac, followers and non-followers of the GFD. Secondly, since MTM is composed by two models, initiation of the behaviour (adherence to GFD) and continuation, were applied respectively to non-followers and followers of the diet. This approach was considered important in order to firstly understand if there is any possibility among

non-followers of the GFD to start following the diet and the reasons why they might start it. However, for the initiation model the dependent variable was the intention to start following the GFD. On the other hand, the continuation model was applied to the followers of the diet to recognize factors which are important for the continuation of the diet. This is relevant because previous studies have suggested that TPB on GFD is not a good tool for improving the behaviour.

Furthermore, constructs for the theoretical models, IM and MTM, were designed based on the results of a review on the adherence to GFD. To date there are two systematic reviews, which have identified factors affecting adherence to GFD. Hall et al. (2009), found that origins, age of diagnosis, emotional and socio-cultural influences, membership of an advocacy group and regular dietetic follow-up are the factors explaining adherence to GFD mostly. However, Hall et al. (2009) did not consider aspects of GF products and they search was limited only to celiac patients. More recently, another systematic review aimed at understanding the relationship between depressive symptoms and adherence to GFD (Sainsbury & Marques, 2018). They found that greater levels of depression are associated with lower adherence to GFD, but the authors suggest to carefully consider these findings because the number of studies meeting the inclusion criteria is limited (Sainsbury & Marques, 2018). Nevertheless, both studies focus on celiac patients and have considered only a few factors affecting adherence to GFD.

In addition to this, we conducted a review considering not only celiac patients but also other people who for reasons other than CD follow the GFD. The review found that the majority of the studies considered celiac and only a very limited number of research has considered parents of celiac patients (Bacigalupe & Plocha, 2015; Tomlin et al., 2014) and non-celiac people voluntary following the GFD (D. M. Lis et al., 2015a). The review showed that some studies have analysed adherence to GFD in a more descriptive way (Araújo & Araújo, 2011; Srihari Mahadev et al., 2013; Ukkola et al., 2012a; Van Hees et al., 2013; Zarkadas et al., 2013) while other studies have tried to test whether different factors affect adherence to GFD. According to the review we conducted, adherence to GFD is affected by eight factors (figure 4-4); however, results are mixed and this might occur for many reasons but most importantly because studies have considered some of the factors and moreover the country where the study was conducted might infer the results.

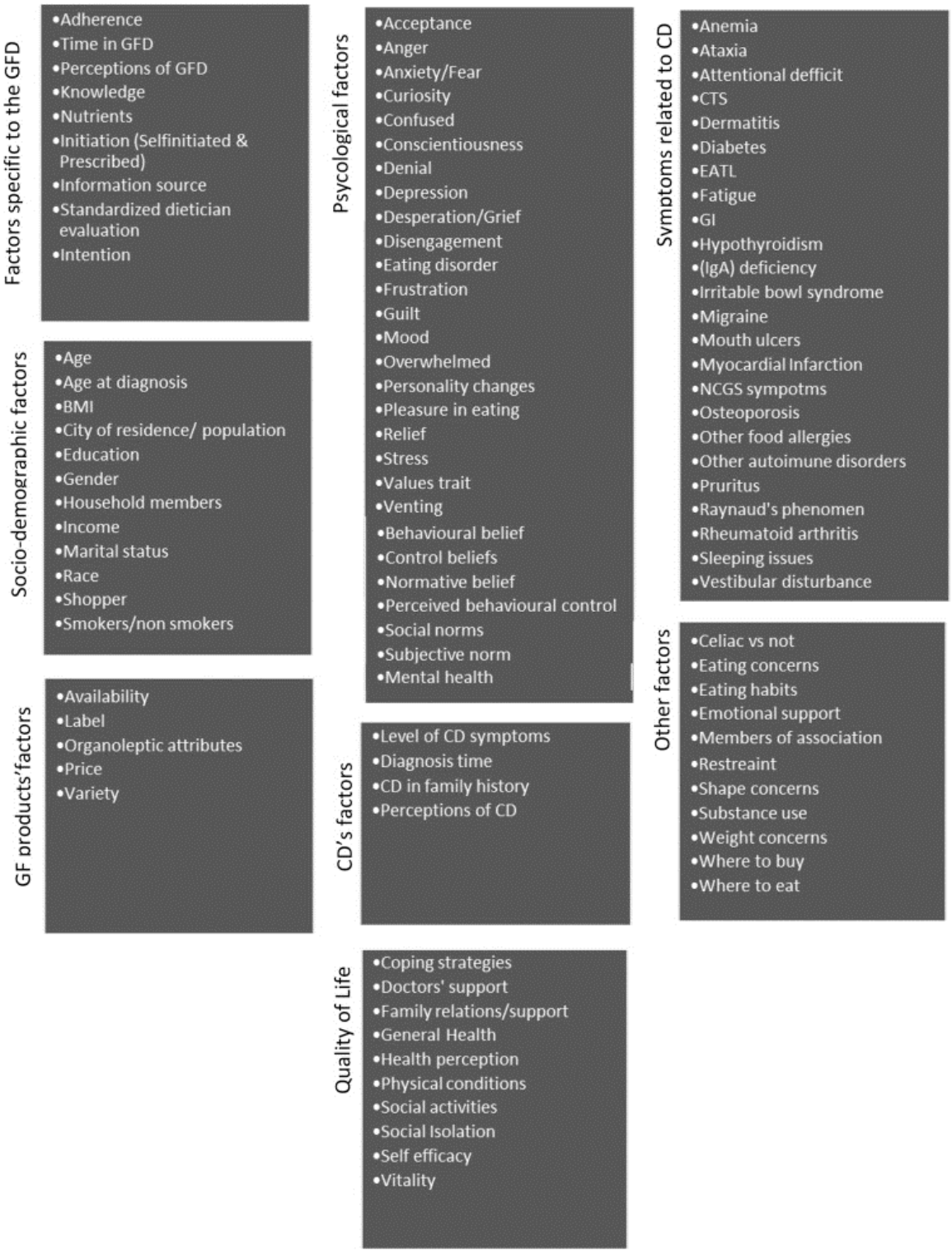

Figure 4-4 Factors affecting adherence to GFD

Thus far we have considered the theoretical constructs of the health belief models and possible factors affecting GFD, the following paragraphs will explain the hypotheses which this research is putting forward and will introduce in a schematic way the models applied to this study.

Going back to the health behaviour models, attitudes are considered as important for explaining the behaviour by both theoretical models, IM and MTM. Therefore, the study proposes the following hypothesis:

Hypothesis 1: Attitudes towards the GFD, influence adherence to GFD

However, MTM distinguishes positive and negative attitudes, in other words according to MTM positive effects of GFD (positive attitudes) and side effects of the GFD (negative attitudes) influence the intention of a person to involve in the behaviour. More formally:

Hypothesis 1a Positive effects of the GFD, influence positively attitudes towards GFD

Hypothesis 1b Side effects of the GFD affect negatively attitudes towards GFD

Normative beliefs or perceived norms (social pressure) is another necessary construct to consider when understanding the behaviour towards health. According to IM social pressure of an individual to perform a certain behaviour is influenced by believes of other significant people in their life or by what other people do (descriptive norms) and think an individual should do in relation to performing or not the behaviour (injunctive norms) (Fishbein, 2008). Hence, the study proposes the following hypothesis:

Hypothesis 2: Normative beliefs improve adherence to GFD
Hypothesis 2a: Injunctive norms affect positively adherence to GFD
Hypothesis 2b: Descriptive norms affect positively adherence to GFD

However, in the MTM this construct does not appear as it is believed that changes in the social environment are more related to performing the behaviour such as the support given by others rather than what they do and/or believe (Manoj Sharma, 2015). Considering results from the review, changes in the social environment are related to constructs of Quality of Life (QOL), which include the degree of satisfaction with the support from family members and friends, and the support given by the medical services. Thus, the hypothesis in this case is:

Hypothesis 3: Support given by others affect positively adherence to GFD

Self-efficacy is one's belief to succeed in a given situation or to achieve a specific behaviour (Bandura, 1982). However, since we are considering followers and non-followers of the GFD, self-efficacy was measured in a likert scale for both groups of participants, but the question was different. (*Please review the Methods' paragraph for a more detailed explanation of this construct.)* However, both variables were integrated in one "Self-Efficacy". Therefore, hypothesis in this case is:

Hypothesis 4: Self-efficacy improves (is positively related) to adherence to GFD

So far, the three classical constructs of the models have been explained and the relative hypothesis have been reported. However, as it was previously mentioned, these constructs are not always explaining the behaviour and other factors related to the environment should also be considered when evaluating a given behaviour (Fishbein, 2008). Nevertheless, in his article of 2008, Fishbein gives possible environmental and skills factors which might affect the behaviour but does not provide specific description for each of them. Hence, we have considered that attitudes towards GF products, QOL, Depression and Anxiety and Knowledge affect adherence to GFD. Thus the hypotheses are:

Hypothesis 5a: Perceptions on GF products affect adherence to GFD.
Hypothesis 5b: Participants with high levels of QOL will improve the adherence to GFD.
Hypothesis 5c: People with high levels of depression and anxiety do not follow a strict GFD.
Hypothesis 5d: Good knowledge affects positively adherence to GFD.

On the other hand, Sharma (2015) describes in detail the constructs covering the environmental factors. Again, there are distinctions between the "initiation model", applied to the non-followers of the GFD, and the "continuation model," applied to the followers of the GFD.

Regarding the "initiation model" changes in the physical environment have been considered as important when predicting the behaviour. In this case, after considering results from the systematic review, attitudes towards GF products have been considered as relevant for the physical environment changes. Hence, the study put forward the following hypothesis:

Hypothesis 6: For non-followers of GFD, attitudes towards GFD are important when predicting the intention to initiate a GFD.
Hypothesis 7: For non-followers of GFD, self-efficacy is important when predicting the intention to initiate a GFD.
Hypothesis 8a: For non-followers of GFD, increasing availability of GF products will increase the possibility to follow GFD.

Hypothesis 8b: For non-followers of GFD, improving sensorial characteristics of GF products will increase the possibility to follow GFD.

Hypothesis 8c: For non-followers of GFD, improving nutritional values of GF products will increase the possibility to follow GFD.

Hypothesis 8d: For non-followers of GFD, decreasing prices of GF products will increase the possibility to follow GFD.

Constructs of the "continuation model" are relatively different form the IM. According to Sharma (2015), emotional status, overcoming barriers and the social environment are considered as important factors for continuing engaging in the behaviour, in this case, the adherence to GFD. Again, considering results of the review, hypotheses for measuring the continuation of GFD are:

Hypothesis 9: For followers of GFD, high level of Depression and Anxiety decreases the level of adherence to GFD

Hypothesis 10a: For followers of GFD, increasing availability of GF products will improve adherence to GFD

Hypothesis 10b: For followers of GFD, improving sensorial characteristics of GF products will improve adherence to GFD

Hypothesis 10c: For followers of GFD, improving nutritional values of GF products will improve adherence to GFD

Hypothesis 10d: For followers of GFD, decreasing prices of GF products will improve adherence to GFD

Hypothesis 11: For followers of GFD, high level of quality of life is associated to better adherence to GFD.

Figure 4-5, 4-6 and 4-7 introduce the theoretical models applied to this study.

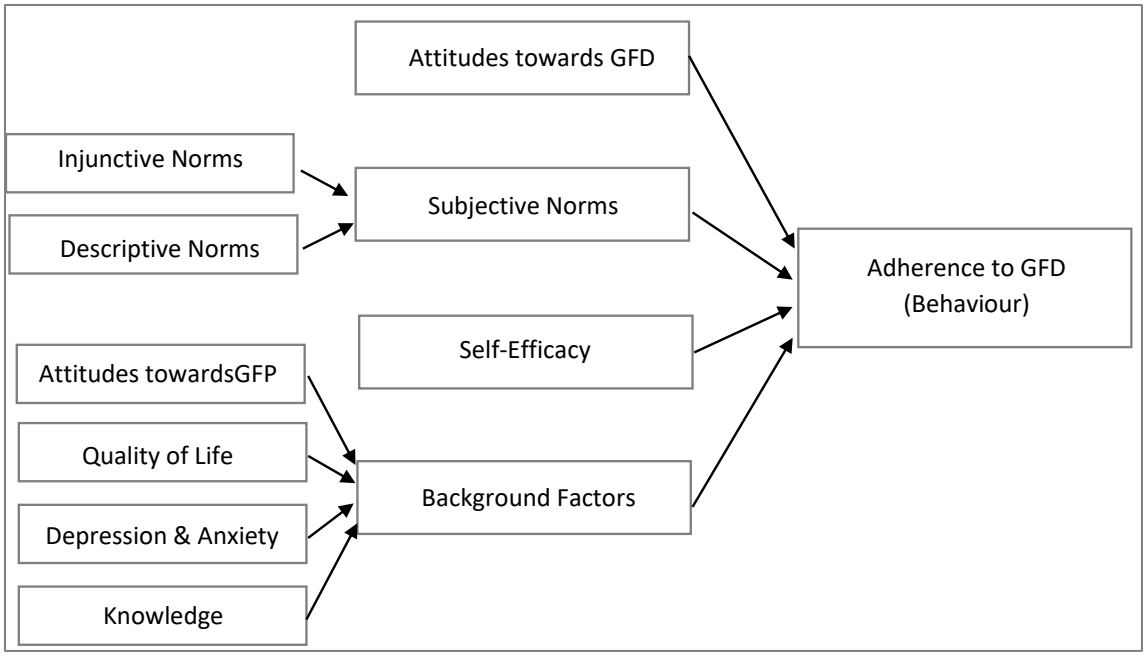

Figure 4-5 Adherence towards GFD explained by the Integrative Model

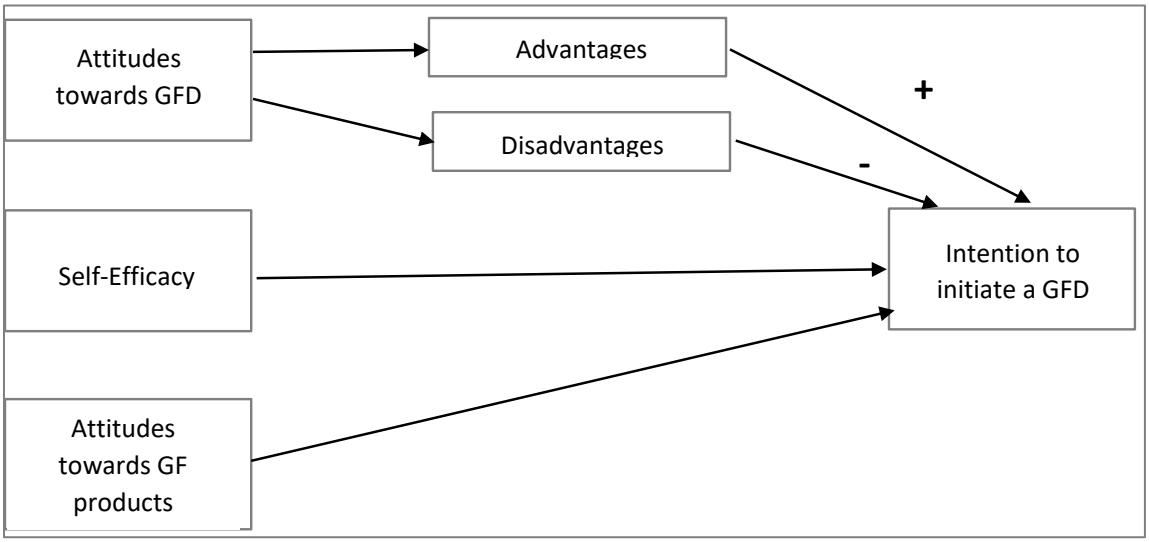

Figure 4-6 Intention to initiate the GFD explained by the Multi Theory Model

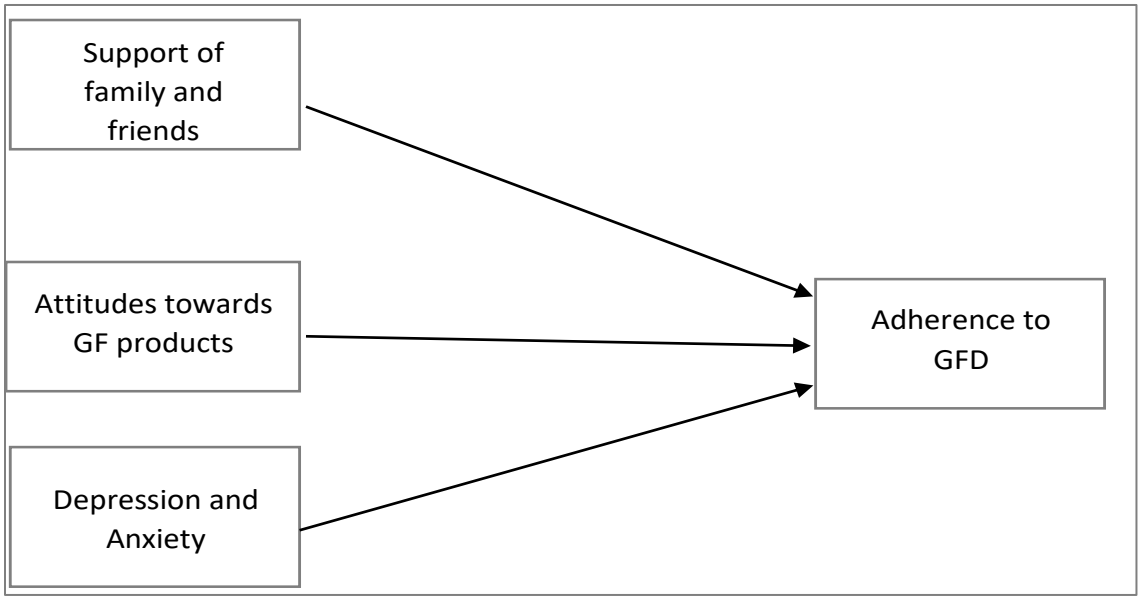

Figure 4-7 Continuation of the GFD explained by the Multi Theory Model

So far, we have tried to understand the behaviour of following the GFD by considering the classical constructs of the behavioural models. However, since the market of GF products is expanding, and more firms are entering the market we consider that economics aspects should also be taken into account when understanding the adherence to GFD and ascertain if an increase on the willingness to pay will increase/improve adherence to GFD.

In the beginning of this article, we explained that supporting celiac people following the diet is very important for their well-being. On the other hand, it was shown that to date it is not scientifically proven that GFD is the best diet for people who do not suffer from any specific disease or symptom related to CD. Hence, a question rises "What if the price of GF products is lower than the conventional counterpart, will non-celiac people buy GF product and consequently follow a GFD?" Thus, the final hypothesis for this study is:

Hypothesis 10: For non-celiac subjects, Willingness to pay is positively correlated with the adherence to GFD

4.4 Data and Methods

4.4.1 Questionnaire Design

The survey was designed in accordance with results of the systematic review and the necessary constructs of the IM and MTM. At first, participants were asked to give consent on the usage of

their data and were assured that all the information they would provide saved their anonymity. The questionnaire was approved by the Bioethics Committee of the University of Bologna, since some of the questions are considered as sensitive.

Subsequently, screening questions were listed, and participants were asked to answer with "Yes" or "No" if they had knowledge about CD, gluten and GF products. Moreover, since the study was addressed to adults, participants were asked if they were 18 years or older. In case participants were answering with "No" to one of these questions they were not allowed to continue with the questionnaire.

The second part of the survey consisted of questions related to the GFD. Firstly, participants were asked to self-declare adherence to GFD. The scale items were developed by the authors. Afterwards, participants that declared to follow GFD were asked a set of questions, developed by Biagi et al., (2009), in order to evaluate the level of adherence to the GFD. Since, it was shown that adherence to GFD is related with the length to GFD, participants were also asked about the time they have been following the diet. Furthermore, another question regarding the initiation of the diet was also included in the second part.

The third part consisted of questions regarding attitudes towards GFD. Participants were asked to evaluate on a scale from 1 (Strongly disagree) to 5 (Strongly agree) a set of statements retrieved from a qualitative study conducted by the authors on consumers' experience when buying GF products, and from existing literature (Edwards George et al., 2009; D. M. Lis et al., 2015b; Sainsbury & Mullan, 2011; Shah et al., 2014; Ukkola et al., 2012a; Villafuerte-Galvez et al., 2015).

The fourth part of the survey presented questions on the diseases and symptoms related to CD and other food allergies that participants could suffer from.

The fifth part consisted of questions related to the GF products. Firstly, participants were asked to evaluate on a scale from 1 (Strongly disagree) to 5 (Strongly agree) the level of agreement with four statements regarding GF products. The second question of this part was about the knowledge on GF products. Participants were asked to evaluate from a given list of products if they were GF, potentially containing gluten, and containing gluten. The scale was developed considering Silvester et al., (2016), nevertheless items were chosen from the web site of the Italian Celiac Association, in order to adjust products to the Italian market (Associazione Italiana Celiachia, 2001). Afterwards, in order to estimate Hypothesis 10, participants were asked about the WTP

for pasta. A contingent valuation (CV) method was adopted for evaluating WTP. CV is a survey-based economic technique consistent with the utility theory (Lancaster, 1966). Firstly, subjects were asked about which pasta they would buy between two options, pasta with teff (a natural GF cereal) and conventional pasta. Subsequently, in relation to the choice they made, they were shown again the two options of pasta, but in this case the price of the pasta they chose in the first option had a higher price. If they choose the pasta with the lowest price, another option was shown to them with a higher price of the chosen pasta. If they stick to their first choice, another option was given to them with a lower price of the pasta they did not choose. The question was not applied to people diagnosed with CD since we consider that they would never buy a conventional pasta.

The sixth part of the questionnaire evaluated the level of Depression and Anxiety. The scale was adopted from Lovibond & Lovibond, (1995). However, considering the length of the questionnaire we reduced the items to six, electing three items per each level, Depression and Anxiety, with the highest score.

Quality of life forms the fifth part of the survey of this study. The scale was adopted from the Burckhardt & Anderson, (2003) since it is a consolidated scale for measuring QOL and has been applied to other studies on GFD. Subjects were asked to estimate on a nine-level scale the way they felt about different aspects of their life. However, an item on the medical support was added since many studies have shown that it affects adherence to GFD (Ferster et al., 2015; Muhammad et al., 2017; J. A. Silvester et al., 2016).

Finally, in order to evaluate the profile of the participants the last part consisted on questions about the socio-demographic characteristics of the sample.

4.4.2 Data collection

The survey was designed and administered using the online survey service Qualtrics. The online survey was conducted from May to August 2018. Participants were recruited through social-media, events dedicated to CD and through visits to supermarkets and specialized stores where they were given leaflets with the link of the survey. Since some of the questions covered aspects of psychological and health statues, and QOL, subjects self-administered the questionnaire in order to reduce the possible biases in case it was administered by the researcher.

Participation was voluntarily and from the beginning subjects were informed that they were not going to receive incentives for participating in the study. In the end of the survey they were asked to leave their email address if they were interested to receive results of the study. The contact survey was designed in order to save the anonymity of the answers, since it was attached as an external survey.

4.4.3 Data analysis

Data were analyzed using R 3.5.1. Firstly, descriptive analysis was carried out in order to understand the general profile of the participants and a description of adherence to GFD, Depression and Anxiety level and QOL. Secondly, prior to the estimation of the models, correlation tests were applied in order to understand if constructs of the model correlated to each other. Ordered logit model, was applied for the estimation of the theoretical models, IM and MTM. This model suits better with the type of the dependent variable (adherence to GFD) that is measured using an ordinal scale and the type of relationship between dependent and independent variables.

Finally, interval regression model was applied in order to estimate the relation between adherence to GFD and WTP for GF pasta with teff.

4.5 Results

4.5.1 Participants' characteristics and adherence to the GFD

A total of 308 respondents completed the survey. Most of the subjects were recruited through social media (54.5%) and activities about CD and face to face (44.8%). The selected demographic attributes are shown in Table 4-1.

Table 4-1 Participants socio-demographic characteristics

Characteristics	Percent of Total (%)
Gender	
Female	80.19%
Male	19.81%
Age (Median, standard deviation)	*39 years old (12.33)*
18-30	26.62%
31-50	52.27%
51-60	16.23%
Older than 60	4.87%

Education level (Median)	*University degree*
Less than middle school	0%
Middle school	4.87%
High school or equal	35.39%
University degree	49.03%
Other	9.74%
Prefer not to say	0.97%
Household income (Median)	*1.500 - 2.500 €/month*
< 600 €	1.64%
600 € - 1500 €	21.10%
1.5001- 2.500 €	23.70%
2.501 –3.500 €	18.51%
3.501 – 4.500 €	5.84%
> 4.500 €	6.49%
Prefer not to say	22.72%
Household income (Median)	*I can occasionally afford some small luxuries*
My income is not enough for necessary purchases	16.88%
I can occasionally afford some small luxuries	51.30%
I can afford everything I need	19.16%
Prefer not to say	12.66%
Background with CD	Non-celiac
Celiac	35.01%
Having a family member with CD	11.69%
Non-Celiac	46.75%

The majority of participants were female (80.19%) and the average age of respondents was 39 years old. This is in line with the fact that CD affects mostly females (P. Singh et al., 2018) and that females are more concerned about food (Charlton et al., 2014; Dean, Lähteenmäki, & Shepherd, 2011) and their body shape (Mooney, DeTore, & Malloy, 1994). Most of respondents have University Degree (49.03%) or a high school diploma (35.39%) and none had elementary education level. Average household income was between 1.500 - 2.500 €/month. In addition, participants were asked to evaluate their incomes. As the table suggests, half of the participants declared that if they manage their incomes, they would afford occasionally some small luxuries. It is important to notice that when asked directly about their incomes, approximately 23% of participants did not prefer to respond, but the number was reduced to approximately 13% when asked about evaluating their incomes. Hence, considering the second method for estimating incomes might be more suitable for next studies.

Since the main objective of this study is understanding and evaluating adherence to GFD, some further analysis was conducted in order to understand the level of adherence to GFD. As it was

mentioned in the section of methodology, adherence was measured by considering the scale used by Biagi et al. (2009) and another scale designed by the authors, in order to evaluate if there is any consistency between what participants declared (authors' scale) and their scored adherence (Biagi's scale). The scored adherence was not applied to the individuals who "*don't mind about the presence of gluten in their diet"*.

Table 4-2 Self-declared adherence

	I don't mind the presence of gluten	I try to balance	I try to avoid gluten	I eat only GF products
Number of subjects	109	34	26	139

According to Biagi et al., (2009), from a clinical point of view, the scored adherence can be divided into three groups: 0-1 point, subjects do not follow a strict GFD; 2 points, subjects are following GFD but with mistakes and 3-4 points, subjects are following a strict GFD.

Table 4-3 Scored adherence (Biagi's scale)

Points	0	1	2	3	4
Number of subjects	166	42	3	47	50

However, as table 4-3 shows, the majority of people declaring to follow a GFD scored 0 points. Hence, it was considered as relevant to understand how self-declared adherence and scored adherence relates to each other.

Table 4-4 Self-declared and scored adherence to GFD

		Scored adherence				
		0	1	2	3	4
Declared adherence	I don't mind the presence of gluten	109	0	0	0	0
	I try to balance	32	0	2	0	0
	I try to avoid gluten	19	7	0	0	0
	I eat only GF products	6	35	1	47	50

As table 4-4 presents, 41 individuals who declared to follow a strict GFD, scored 0-1 points, suggesting that they do not follow a strict GFD. This is very important, especially for individuals who follow GFD because of health problems.

Considering the previous results, it was relevant to merge the results from the two scales and create a new variable which presents the adherence to GFD from all the subjects of the study. The new adherence variable has 3 levels, where 1= do not follow a GFD, 2=follow the GFD with mistakes and 3= follow a strict GFD (Table4-5).

Table 4-5 Adherence to GFD

	Adherence to GFD		
	Do not follow GFD	Follow GFD with mistakes	Follow strict GFD
Number of subjects	109	102	97

Since many studies suggest that people who follow a GFD suffer from low levels of QOL, high depression and anxiety, and have excellent knowledge towards the diet, ANOVA was applied for understanding if there are any differences between people who follow and do not follow a GFD[6]. Results show that there is no difference on the level of QOL and the scale of Depression and Anxiety. However, there are high differences on the level of knowledge between the groups. Table 4-6 shows results on the percentage of the subjects belonging to each category.

Table 4-6 Participants' Quality of Life, Depression and Anxiety and Knowledge level

	Adherence to GFD		
	Do not follow GFD	Follow GFD with mistakes	Follow strict GFD
Quality of life			
Low	0.32%	0.65%	0.65%
Average Low	3.25%	4.22%	3.57%
Medium	17.86%	15.58%	14.29%
Average high	12.66%	11.69%	9.74%
High	1.30%	0.97%	3.25%
Depression & Anxiety			
Absent	2.60%	4.55%	4.22%
Low	29.22%	23.70%	21.10%
Medium	3.25%	4.22%	5.19%
High	0.32%	0.65%	0.97%
Knowledge			
Low	10.71%	6.82%	3.90%
Average	21.10%	18.83%	11.36%
Good	3.25%	6.82%	12.99%
Excellent	0%	0.65%	3.25%

4.5.2 Results on IM and MTM explaining adherence to GFD. Verification of hypotheses

Results on IM are shown in table 4-7. As it is observed, factors affecting adherence to GFD are related to attitudes towards GFD, injunctive norms, self-efficacy and background factors such as knowledge and attitudes towards GF products. Hence by considering hypothesis we made in section 4.3 and results we obtained from the model, we can conclude that Hypotheses 1, 2b, 4, 5a and 5d are confirmed.

Table 4-7 Integrative model

		Dependent variable:
		Adherence to GFD
Attitudes towards GFD	GFD reduces symptoms of CD	0.215**
	People who follow a GFD have a healthier diet	0.246**
	GFD helps to lose weight	-0.244**
	A person should follow GFD only if prescribed by a health professional	0.278**
Injunctive norms	My family and friends think I should follow GFD	1.085***
Self - efficacy	I manage/I would manage very good the GFD	0.351***
Background	Knowledge	0.165***
	GFP products are more expensive than conventional	0.405*
	Observations	308

Note: *p<0.1; **p<0.05; ***p<0.01

Finally, by considering the above results, our final IM for adherence to GFD is shown in figure 4-8

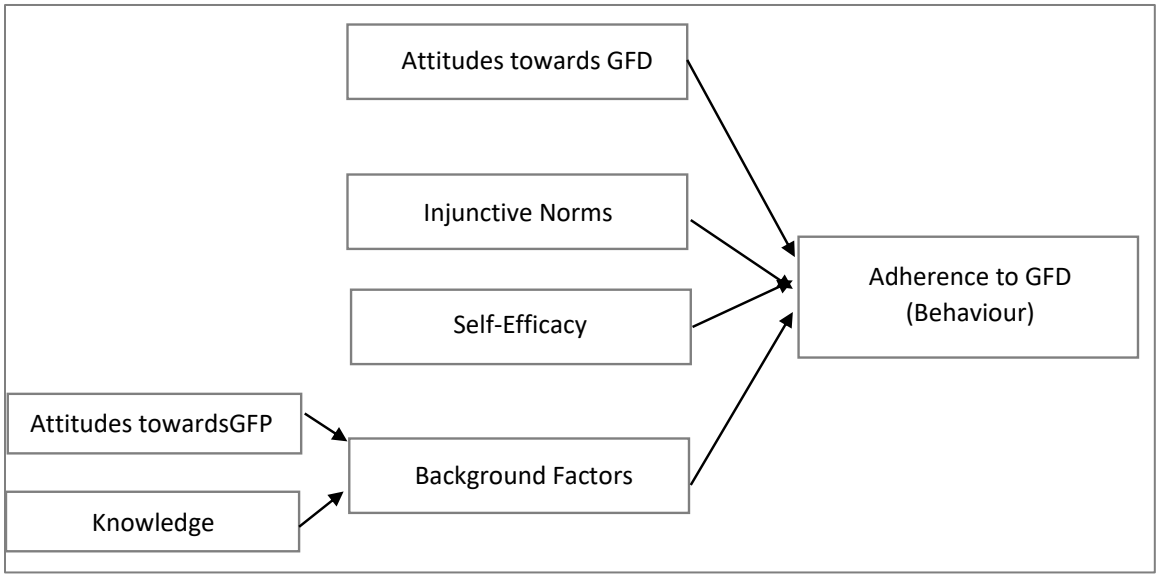

Figure 4-8 Integrative model explaining adherence to GFD

Regarding continuation model, we applied it only to followers of GFD. However, our analysis fou nd that none of the factors explain the continuation of the GFD. Thus, we can't confirm any of th e hypotheses we put forward in this study regarding continuation model.

On the other hand, concerning the initiation of the GFD, we applied it only for non-followers of t he diet. In this case the dependent variables was not the adherence to GFD but intentions of sub jects to start following the GFD, measured in a 5 point scale. Results are shown in table 4-8. As it is observed, people who think that following a GFD helps to maintain a healthier diet and helps y ou to be more active physically tend to agree with the fact that they might start following a GFD. Thus, considering the hypotheses for the initiation model and these results we confirm only hyp othesis 6. Hence, believes play an important role for non-celiac people who think to follow a GFD

Table 4-8 Initiation Model

	Dependent variable:
	Intention to start following GFD
People who follow a GFD have a healthier diet	0.449^{**}
People who follow GFD are more active compared to the ones that don't	0.614^{***}
Observations	109

Note: *p<0.1; **p<0.05; ***p<0.01

The final model of the initiation model is shown in figure 4-9.

Figure 4-9 MTM applied to adherence to GFD, Initiation Model

4.5.3 Willingness to pay for pasta with Teff by non-celiac consumers

Results of the interval regression model are shown in table 4-9. As it is observed, the WTP for people who choose to buy conventional pasta when no price is provided goes down by approximately € 2.8 for 500 grams of pasta with teff. Regarding adherence to GFD, the WTP for people who follow a GFD with mistakes tend to increase by €0.5 for 500 grams of pasta with teff compared to the ones that do not follow GFD. Furthermore, for people who follow a strict GFD the WTP increases by approximately €1.7 when compared with the ones that do not follow GFD. Thus, this results confirm the fact that the WTP is higher for individuals who follow a strict GFD. Hence hypothesis 10 of this study is confirmed.

Table 4-9 Willingness to pay for pasta with teff

	Dependent variable:
	WTP for pasta with teff
Between conventional pasta and the one with teff, which one would you buy? (No price provided)	-2.811***
Adherence to GFD (2)	0.500*
Adherence to GFD (3)	1.667***
Observations	200

Note: *p<0.1; **p<0.05; ***p<0.01

4.6 Discussion

Recently, a high number of people are following the GFD. Apart from celiac patients, non-celiac people are also embracing the GFD. The reasons for this are different, but most of them follow the GFD because prescribed by a health professional, since GFD, according to some research, might improve symptoms of other diseases. In addition, celiac patients' family members are following the GFD at home in order to avoid possible food contamination. Furthermore, other non-celiac people are voluntarily following the diet because they believe it is healthier and helps

them stay in shape. Nevertheless, to date research has not verify these believes. Contrary, it has been shown that GF products suffer from low nutritional properties. Hence, the aim of this research was to shed light on some of the main factors affecting adherence to GFD for celiac and non-celiac people by considering the HBM. IM and MTM were taken into account since IM includes all the previous theories on health behaviour and the MTM is one of the most recent theories in the field. Moreover, MTM states that health behaviour is composed by two important moments, intentions to initiate the behaviour and continuation, and this fits the present study, since participants are followers and non-followers of the diet.

Results show that adherence to GFD is affected by believes and attitudes towards the diet. It was found that believing that GFD improves the symptoms of CD, should be started only if prescribed by a health professional and that people who follow GFD have a healthier diet explains adherence to GFD. However, it is not believed that GFD helps to lose weight. These results are in line with other studies which have found that perceptions on GFD are very important when embracing the GFD (Leffler et al., 2009, 2008; Sainsbury & Mullan, 2011; Villafuerte-Galvez et al., 2015).

Furthermore, this study found that self-efficacy and injunctive norms, what other family members and close friends think a person should do, are also important factors that should be taken into account when trying to understand the behavior towards GFD. Previous studies have found similar results. According to Ford, Howard, & Oyebode (2012), perceived self-efficacy should be considered for psychological interventions for individuals with CD.

Finally, background factors, knowledge and perceptions that GF products are expensive, are explaining adherence to GFD. Other studies have also found that people with high level of knowledge regarding GFD have higher possibilities to follow a strict GFD (Leffler et al., 2008; Muhammad et al., 2017; Rajpoot et al., 2015; Rocha et al., 2016; Jocelyn A. Silvester, Weiten, Graff, Walker, & Duerksen, 2016; Villafuerte-Galvez et al., 2015). Furthermore, other studies have also found that GF products are generally perceived as expensive by participants, celiac and non-celiac participants (Araújo & Araújo, 2011; Bacigalupe & Plocha, 2015; do Nascimento, Medeiros Rataichesck Fiates, et al., 2014; Ferster et al., 2015; Leffler et al., 2008; Rajpoot et al., 2015; Tomlin et al., 2014).

Previous research on GFD have found that QOL and depression and anxiety levels are important factors in explaining the behavior towards GFD (Barratt et al., 2011; Borghini et al., 2016; Francesc

Casellas et al., 2008; Francisco Casellas et al., 2015; CASTILHOS et al., 2015; SriHari Mahadev et al., 2015; Paarlahti et al., 2013; Peters et al., 2014; Rose & Howard, 2014; Sainsbury & Mullan, 2011; Sainsbury et al., 2015a, 2013b, Ukkola et al., 2011, 2012b). However, in this study we did not find the same results. Moreover, we found that there are no statistical differences on the QOL scores and depression and anxiety levels between subjects who do not follow GFD, follows the GFD with mistakes and the ones who strictly follow the diet. However, it is important to stress that to date studies have measured factors affecting adherence to GFD by considering celiac and non-celiac who follow GFD separately. Hence, it is relevant that future research considers these both groups simultaneously in order to prove results of this study.

Another important point of this study was to find out how health beliefs model differ in explaining a given behaviour, adherence to GFD. We found that constructs of the IM explain the adherence to GFD, which is affected by attitudes towards GFD, injunctive norms, self-efficacy and background factors such as knowledge and attitudes towards GF products. However, regarding the MTM, constructs of the continuation models did not explain adherence to GFD, but we found that intentions to start following the GFD depend on attitudes towards it. Nevertheless, other studies have found that MTM is a good predictor for both starting and continuing the behaviour (M Sharma et al., 2017; Manoj Sharma, 2017; Manoj Sharma et al., 2017, 2016). Still, it is important to stress the fact that in this research, for the continuation model we measured the actual behaviour (adherence to GFD) and for the initiation model the intention to start the behaviour (initiating the GFD). Thus, future research should carefully consider if the MTM is a good predictor for the intention only or for the actual behaviour.

Finally, since GF products are generally considered as expensive, we aimed to understand if there is a WTP for GF pasta with teff by non-celiac consumers, following or not the GFD. We found that people who buy conventional pasta have a negative WTP for GF pasta with teff. However, we saw that WTP is positively related to the adherence to GFD. However, previous research on WTP for GF products is very limited. Thus, it is difficult to confirm these results. Hence, future research should consider economic aspect important since the market and demand for GF products is increasing and it is crucial to provide insights for the firms who are already operating in the market or are willing to do so in the future.

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Chapter 5

Consumers' Preferences and Willingness to Pay for Gluten-Free Pasta with Teff

Abstract

The market of GF products is expanding rapidly in the recent years. This mainly because of the increasing popularity of the gluten-free diet (GFD). However, research on preferences for GF products is very limited. Thus the main objective of this research is to identify preferences for GF pasta for celiac and non-celiac consumers. In order to achieve this objective discrete choice experiments were designed in order to elicit consumers' preferences for brand and label. In addition, average willingness to pay (WTP) was calculated. Results indicate that brand and label are important attributes for consumers. However, only celiac patients are willing to pay a premium price for branded GF pasta.

Keywords: gluten-free pasta, teff, choice experiment, brand, label, willingness to pay

5.1 Introduction

Gluten-free (GF) products are becoming very popular recently. According to the European Union, products might be considered as GF if the gluten content does not exceed 20 mg/kg in the food as sold to the final consumer ("(EU) No 828/2014," 2014). This is very important since to date gluten-free diet (GFD) is the only scientifically proven treatment for people suffering from celiac disease (CD), an autoimmune disorder of the small intestine caused by the ingestion of gluten (Trier, 1998). However, apart from celiac patients, other people are consuming GF products. Firstly, family members of celiac patients are consuming GF products at home in order to avoid contamination. Secondly, studies suggest that eating GF products should be supported for other diseases and symptoms, such as dermatitis herpetiformis, anemia, irritable bowel syndrome, rheumatoid arthritis, diabetes mellitus, HIV-associated enteropathy and other neurologic disorders (Bürk et al., 2009; El-Chammas & Danner, 2011; Srihari Mahadev et al., 2013; Samasca et al., 2017). A third group of consumers are the ones that eat GF products voluntarily, because they consider them as a healthier option (D. M. Lis et al., 2015a) and sometimes they are affected

by celebrities whom also consider GF products as improving their body shape (InStyle, 2017; Probiotics.org, 2015; Ranker, 2015).

Thus, due to the increasing number of people consuming GF products, the market for this category of products has expanded over the last years. While in 2005, retail sales were just under US$1 billion, in 2015 they reached US$3.3 billion globally, with the US, UK and Italy being the most important contributors of the growth (Baroke, 2016). Furthermore, for the period 2010-2015, bread, biscuits and pasta were the products which consumers demanded the most c, where pasta it is foreseen to have the highest sales in Italy, France and Portugal for the period 2015-2020 (Euromonitor, 2016). However, it is necessary to understand if this is a temporary trend or if there will be a continuous increase of the sales of GF products. Furthermore, in order to make precise estimations about the future of GF products, it is important to understand consumers' preferences. Which are the attributes they appreciate the most?

Thus, the main objective of this study is to understand consumers' preferences for GF products. In order to elicit consumers' preferences a choice experiment framework was used, which allowed individuals to select between four alternative options, three types of Pasta with teff with different attribute levels, and the status quo, the pasta that they usually buy. In addition, questions regarding the level of the adherence to the GFD, attitudes towards Gf products, knowledge, health status and socio-demographic questions were also included in the final questionnaire in order to identify the characteristics of the participants and understand the reasons why they choose or not choose GF products.

Finally, pasta was elected since GF pasta is foreseen to have the highest sales in Italy (Baroke, 2016) and since Italy is the first producer and the biggest consumer of the product in the world (Union of Organizations of Manufactures of Pasta Producers, 2015b). Moreover, considering results of the qualitative study, it is considered one of the best GF products, which means that it might have high potential to be consumed also by non-celiac people.

5.2 Background

As it was previously mentioned, the number of people buying GF products is increasing rapidly in the last years. However, while it is understandable that celiac patients buy GF options, the reasons

why non-celiac people choose to buy them remain unclear. However, to date no research has shown that GF products are healthy for people who do not suffer from any specific health condition (Gaesser & Angadi, 2012; Marcason, 2011; Niland & Cash, 2018). Contrariwise, some research have found that GF products have low nutritional properties (Babio et al., 2016; Bardella et al., 2000; Estévez et al., 2016; Tricia Thompson et al., 2005). Furthermore, GF products are considered as less tasty (Arendt & Dal Bello, 2008; Arendt et al., 2002; do Nascimento, Medeiros Rataichesck Fiates, et al., 2014); are more difficult to find at the grocery shops and/or supermarkets (do Nascimento, Medeiros Rataichesck Fiates, et al., 2014; Ferster et al., 2015; J. Singh & Whelan, 2011) and are more expensive (Fry et al., 2018; Missbach et al., 2015b; J. Singh & Whelan, 2011) compared to the same conventional options.

However, research is trying to improve these shortcomings, by developing new products which meet the necessary nutritional and sensorial requirements. One of the latest trends are products produced with Teff which is a natural GF cereal. Several studies have indicated this cereal as rich in essential amino acids, minerals, polyphenols and dietary fibres (Bultosa, 2015), iron and has more calcium, copper and zinc than other cereal grains (Abebe et al., 2008). Moreover, it is suitable for different climate conditions (Assefa et al., 2015). Hence, teff might be a good option for improving the nutritional properties of GF-products since it is one of the main concerns of the research so far.

To date, teff has been tested mainly to bread products (Campo, del Arco, Urtasun, Oria, & Ferrer-Mairal, 2016; Moroni, Arendt, & Bello, 2011; Wolter, Hager, Zannini, & Arendt, 2014; Zhu, 2018), pasta (Giuberti, Gallo, Fiorentini, Fortunati, & Masoero, 2016; Hager, Lauck, Zannini, & Arendt, 2012) and GF beverages (Gebremariam, Abegaz, Zarnkow, & Becker, 2015; Gebremariam, Hassani, Zarnkow, & Becker, 2015; Gebremariam, Zarnkow, & Becker, 2013b, 2013a). Different aspects of pasta produced with teff were compared to the conventional wheat pasta. It was shown that sensorial characteristics of teff pasta remain lower when compared to wheat and oat counterpart (Zhu, 2018). However, it was noticed that nutritional properties of teff pasta were higher when compared with the ones of wheat pasta. Teff spaghetti had a lower predicted glycemic index (pGI) than wheat spaghetti, but the pGI was higher compared to oat spaghetti (Zhu, 2018). Moreover, teff and oat spaghetti had higher content of dietary fiber and minerals when compared to wheat ones (Zhu, 2018). Regarding elasticity, teff and oat spaghetti had lowers

scores but in terms of cooking time and texture they scored similar to the wheat spaghetti. Hence, teff should be considered as relevant option in the category of GF pasta (Zhu, 2018).

While the research on improving GF products' characteristics is increasing, research on the acceptance of these products from the general population and the prices that they are willing to pay is still limited. To the best of our knowledge there are five studies which have analyzed consumers' buying behavior for Gf products. Three of them have focused on non-celiac consumers.

Studies have found that when comparing GF and conventional snacks, consumers' evaluation of taste, smell and sight was similar for both products. However, taste and smell did not influence willingness to pay (WTP) for the GF snack (De-Magistris et al., 2015). Moreover, de Magistris, Xhakollari, & Munoz (2015), showed that non-celiac consumers were not willing to pay a premium price for the GF snack, suggesting that the labelling does not have any effect on possible confidence and/or loyalty of non-celiac consumers towards these types of products. In addition, socio-demographic factors appear to affect intention to buy for GF products, suggesting that better knowledge and positive attitudes towards GF products is positively correlated with intention to buy (de Magistris, Belarbi, & Hellali, 2017).

The other two studies focus on people who buy GF products (Joshi & Laine, n.d.; Masih, 2018). Masih (2018) found that there were some differences between consumers in USA and India. While the factor analysis for consumers in India identified 4 factors related to: brand packaging; product features; place and promotion, and pricing and labelling, in USA the analysis revealed as relevant for consumers' preferences 6 factors: Safe food attributes, product features, place and promotion, social awareness, product sale, and product visibility. However, as it is observed, product features and place, and promotion are important for consumers in both countries.

The other study focused on consumers' purchase experience. They found that females, 35-59 years old are the potential buyers of GF products, since they are the ones responsible for grocery shopping at home. Furthermore, the study shows that taste, quality and price are the most important attributes for the consumers who buy GF products (Joshi & Laine, n.d.).

Finally, we conducted a qualitative study on the purchase experience of consumers in Emilia-Romagna region in Italy. Results suggest that price is considered high, except for celiac patients, who declared that it was high, but they receive the ASL vouchers and don't pay directly from their

pocket. Furthermore, regarding brands the majority of participants in the study recognized Dr. Schär as the most important brand and this is in line with findings from the research of Euromonitor (Euromonitor, 2016).

Moreover, another question that arises is about the safety of the GF products, thus participants in the qualitative study were asked on how they recognize the GF products. Most of them declared that they rely on the written "Gluten-free" and often read the list of ingredients. However, the "Crossed grain" labels, issued by the Italian Celiac Association (ICA) is recognized by all participants. In addition to these labels, the label of the Ministry of Health also operates in the Italian market, based on the European Union's legislation for GF products. However, most of the participants did not recognize this label.

Nevertheless, the above studies on preferences for GF products have applied a survey in order to understand consumers' acceptance and preferences for GF products. We think that even though they are a highly used method, still they represent a bias. We consider that in order to elicit consumers real preferences, it is important to create a similar buying environment, which was not done in the studies mentioned above.

Hence, in order to elicit celiac and non-celiac consumers' preferences and WTP for GF products, we are going to apply both a hypothetical choice experiment and a survey for measuring consumers' acceptance for GF pasta. Furthermore, the above studied have focused only on one group of consumers, it is to say celiac or non-celiac consumers. This study will invite both groups in order to see if there are any differences between participants.

Thus, the main objective of this study is to understand consumers' preferences for GF pasta produced with teff. In order to achieve the main objective, specific aims will be:

1. Understand consumers' preferences for GF pasta and identify differences between celiac and non-celiac consumers
2. Understand attributes which are more important for consumers when buying GF pasta
3. Calculate consumers' WTP for GF pasta with teff

5.3 Data and methods

5.3.1 Survey procedure

The survey was administered through Qualtrics. It was designed in accordance with results from a systematic review and a qualitative study conducted by the authors. Data were collected during August-September 2018. The questionnaire was conducted in Italian and it lasted less than 10 minutes. Participants were recruited through social-media, events dedicated to CD and through visits to supermarkets and specialized stores where leaflets were given with the link of the survey. Subjects self-administered the questionnaire in order to reduce the possible biases in case the questionnaire was administered by the researcher.

Participation was voluntarily and from the beginning subjects were informed that they were not going to receive incentives for filling out the questionnaire. At the end of the survey they were asked to leave their email address if they were interested to receive results of the study. The survey was designed in order to save the anonymity of the answers, since it was attached as an external survey.

At first, participants were asked to give consent of the usage of their data and were assured that all the information they would provide saved their anonymity.

Subsequently, considering the fact that questions were related to GF products and pasta, a set of screening questions were listed where participants were asked to answer with “Yes” or “No” if they knew gluten and GF products and if they were buying pasta. Moreover, since the study was addressed to adults, participants were asked if they were 18 years or older. In case participants were answering “no” to one of these questions they were not allowed to continue the survey.

The first part of the questionnaire was dedicated to the buying habits of pasta, in order to identify the type of pasta participants usually buy. They were asked about the Brand, Price for 500 gr of pasta and if the pasta they usually buy was containing any specific label. Afterwards, a cheap talk was introduced to them in order to avoid hypothetical biases, which are very common when applying hypothetical discrete choice experiment (Alfnes, Guttormsen, Steine, & Kolstad, 2006; Lusk & Hudson, 2004; Neill et al., 1994; Silva, Nayga, Campbell, & Park, 2011; Yue & Tong, 2009). Subsequently, the procedure of the choice experiment was introduced to the participants. In order to simulate a real buying environment, only an explanation of teff was given and it was explained that 9 taks were going to be shown to them and that each task comprised four

alternatives, three alternatives with teff pasta and the fourth alternative was the pasta they usually buy.

The second part consisted of questions related to the GFD. Firstly, participants were asked to self-declare adherence to GFD. The scale items were developed by the authors. Afterwards, participants that declared to follow GFD were asked a set of questions, developed by Biagi et al., (2009), in order to evaluate the level of adherence to the GFD. Since, it was shown that adherence to GFD is related with the length to GFD, participants were also asked about the time they have been following the diet. Furthermore, another question regarding the initiation of the diet was also included in the second part.

The third part consisted of questions related to the GF products. Firstly, participants were asked to evaluate on a scale from 1 (Strongly disagree) to 5 (Strongly agree) the level of agreement with four statements regarding GF products. The second question of this part was about knowledge on GF products. Participants were asked to evaluate from a given list of products if they were GF, potentially containing gluten, and containing gluten. The scale was developed considering Silvester et al., (2016), nevertheless items were chosen from the web site of the Italian Celiac Association, in order to adjust products to the Italian market (Associazione Italiana Celiachia, 2001).

The fourth part of the survey presented questions on the diseases and symptoms related to CD and other food allergies that participants could suffer from.

Finally, in order to evaluate the profile of the participants the last part consisted on questions about the socio-demographic characteristics of the sample.

5.3.2 Choice Experiment design

5.3.2.1 Theoretical overview

Choice experiments are based on the Lancaster theory of consumer choice (Lancaster, 1966) which states that the utility of a good is constituted by the utilities of the attributes that the good is composed. Since goods are made up of different attributes, the utility of a good is the sum of the utility of each attribute. Thus, utility derives from the attributes and the levels of the attributes. When consumers choose a good, they make tradeoffs between attributes and the levels of the attributes (James & Burton, 2003).

Another theory which choice experiments are based on, is the random utility theory (RUT), which states that consumers are rational, and they choose the option/good that maximizes their utility under the budget/income constraint. Another important assumption of choice experiment is that alternatives are exhaustive; mutual exclusive and finite (Train, 2009).

While consumers know the utility of each choice they make, the researcher does not. The researcher partly knows the utility of the consumer for a given alternative, however there is an unknown part which he/she can't measure. Hence, the random utility function (*Uij*) for the consumer *i* for the chosen option *j* is:

$$U_{ij} = V_{ij} + \varepsilon_{ij}$$

Where V_{ij} is the known utility (deterministic component) and ε_{ij} is the unknown part (stochastic error).

When the consumer is facing a choice set, *Ci*, with *J* options, the probability of the consumer *i* choosing alternative *j* is the same to the utility of the alternative *j*, U_{ij} equal to or greater than the utilities of all other alternatives in the choice set. Hence, the probability that the consumer *i* chooses alternative *j* is:

$$Prob_{ij} = Pr(U_{ij} \geq U_{ik}, \text{ for all } k \in C_i \text{ with } k \neq j)$$

$$Prob_{ij} = Pr(V_{ij} + \varepsilon_{ij} \geq V_{ik} + \varepsilon_{ik}, \text{ for all } k \in C_i \text{ with } k \neq j)$$

However, in order to make precise recommendations it is necessary to estimate the parameters of the utility. In order to do so it is important that the data from Choice Experiments integrates to econometric models which are the ones that generate the quantitative results.

To date, research has used different models which should be considered carefully based on the assumptions they made. On account of its convenience in calculation multinomial logit model (MNL) is the most traditional model used for choice experiments. It assumes that consumers have homogeneous preferences and that the random errors (εij) are independently and identically distributed (i.i.d.) in which each random variable has the same probability distribution and all are mutually independent. According to (Train, 2009), due to this assumptions MNL represents some limitations:

- MNL can represent only systematic taste variation (taste variation that relates to observed characteristics) but not random taste variation.
- MNL implies proportional substitution across alternatives (independence from irrelevant alternatives IIA).
- MNL cannot handle situations where unobserved factors are correlated over time.

Nevertheless, the Mixed Logit Model (MLM) reduces these limitations of MNL since it allows the random taste variation within the survey population, unrestricted substitution patterns, and correlation in unobserved factors over time (Hensher & Greene, 2013; Train, 2009). For MLM, a change in one alternative will not have a proportional effect on the choice probabilities of the other alternatives. In addition, it allows heteroscedastic and freely correlated error terms (Alfnes, 2004).

However, in this paper we are going to propose also another model, the latent class model (LCM) which is a semiparametric alternative of the MNL and resembles the MLM. Nevertheless, it is somewhat less flexible than MLM since it allows discrete taste variation, but it does not require the analyst to make specific assumptions about the distributions of parameters across individuals (Greene and Hensher, 2003).

Theoretically LCM states that subjects' behavior depends on attributes which are observable and on latent heterogeneity, which varies with factors that are unobserved by the analyst. In addition, consumers are assumed to have similar preferences within a given group and different among a set of classes. Hence, the LCM measures, for each class, specific parameters and probability which belongs to the classes. Thus, in this case, the utility of individual *i*, belonging to a class *q* and choosing alternative *j* is:

$$U_{ji|q} = \beta_q X_{ji} + \varepsilon_{ji}$$

where $U_{ji|q}$ is the utility of alternative *j* to individual *i*, belonging to class *q*; β_q the class specific parameter vector; x_{ji} is the vector of attributes and ε_{ji} is the unobserved heterogeneity. Moreover, the probability of an individual *i* choosing alternative *j* in a choice set *t* is a function of the individual's class membership *q*.

$$\text{Prob} \quad = \frac{\exp(\mathbf{x}'_{it,j}\boldsymbol{\beta}_q)}{\sum_{j=1}^{J_i} \exp(\mathbf{x}'_{it,j}\boldsymbol{\beta}_q)} = F(i,t,j\,|\,q).$$

5.3.2.2 Attribute and levels

Attributes and levels of the choice experiment were chosen in accordance with the results from a qualitative study conducted by the authors. In total 3 attributes were selected with three levels each.

Attribute 1 > Brand – in the qualitative study it was shown that consumers prefer different brands for different products. However, Dr Schär, is one of the most recognized brands and this was shown also in the study conducted by Euromonitor in 2016. Moreover, consumers are very open to new brands and options, hence Nativa was chosen as the second attribute level since it is quite a new brand specialized in producing products with teff. The third level was the brand BeneSi, the brand of Supermarket Coop, a very well-known supermarket chain in the region of Emilia-Romagna.

Attribute 2 > Label – three levels were chosen for this attribute. The "crossed grain" is the oldest label in the market. It is issued by the ICA and it was a guaranty for the celiac consumer before the European regulation, this label still operates in the market. Moreover, after the European legislation the Italian Ministry of Health started to issue the label of the Ministry, however the results of our qualitative study show that the majority of participants did not recognize this label. The written "Gluten-free" was also considered as a level for the attribute "label" since the qualitative study show that a lot of consumer rely on this written as well when they purchase GF products.

Attribute 3 > Price – price levels were chosen considering the average price of conventional pasta. The maximum price corresponded with the average price of GF pasta.

Table 5-1 shows the attributes and the levels chosen for this study. Each product possessed the same characteristics, produced with teff, have the same form and the same weigh (500 gr).

Table 5-1 Attributes and levels

Pasta attribute	Attributes' level		
Brand	Schär	Nativa FOOD	Bene.Sì coop
Label		ALIMENTO SENZA GLUTINE PRODOTTO EROGABILE MINISTERO DELLA SALUTE REGISTRO NAZIONALE	SENZA GLUTINE
Price	0.99 Euro/500 gr	2.17 Euro/500 gr	2.99 Euro/500 gr

5.3.2.3 Choice Experiment Design

Ngene 1.1.1 was used to design an optimal orthogonal design (OOD). OOD maximizes the differences in the attribute levels across alternatives, consequently the information obtained from respondents answering SC surveys by forcing trading of all attributes in the experiment is maximized. OOD are orthogonal within an alternative but have (often perfect negative) correlations across alternatives (Street, Burgess, & Louviere, 2005).

In order to avoid confounding between the constants of the baseline and the constants of the model, effects coding was used in the design of the model (Bech & Gyrd-Hansen, 2005). The utility function for the design was:

$$U = f\{Price, Brand, Label, \varepsilon\}$$

The choice design had 9 choice tasks with 4 alternatives each, where 3 alternatives comprised the pasta with teff with one level for each attribute and the fourth alternative was the pasta which the subjects usually buy. Figure 5-1 shows an example of the choice task.

The following pasta products have the same shape and a weight of 500 gr.

Please choose the alternative you would buy if you found it at the store where you usually purchase.

Figure 5-1 Example of a choice task

5.3.3 Model specification and statistical analysis

Data were analyzed using R 3.5.1. At first descriptive analysis was applied in order to depict participants' socio-demographic characteristic, adherence to GFD, knowledge about GF products and if they or a family member of them were suffering from CD. In addition, a description of the pasta participants' usually buy was given in terms of price, label and brands, same attributes used to design the choice experiment.

Considering that one of the aims of this study is to discern differences between celiac and non-celiac-consumers, price, brand and label were interacted with the individual being celiac or not. Moreover, since GF products are perceived as expensive, for LCM classes were build according to incomes. However, incomes support the creation of the classes, but the level of incomes for each class is not known for us.

Model specification:

$$V_{ijt} = \alpha + \beta_1 Price_{ijt} + \beta_2 Price_{ijt} * Celiac + \beta_3 LabelMinistry_{ijt} + \beta_4 LabelMinistry_{ijt} * Celiac + \beta_5 LabelGF_{ijt} + \beta_6 LabelGF_{ijt} * Celiac + \beta_7 BrandNativa_{ijt} + \beta_8 BrandNativa_{ijt} * Celiac + \beta_9 BrandBeneSi_{ijt} + \beta_{10} BrandBeneSi_{ijt} * Celiac + \varepsilon_i$$

Where *Vijt* is individual utility for each participant, alternatives, and choice task; *i* = 1, ..., *N* is the number of the participants, *t* is number of choice task, *j* is alternative A, B, C and D (status quo/the pasta participants usually buy); α is the constant for estimating the utility of participants at the status quo, $Price_{ijt}$ is the price for 500 gr of pasta of alternative *j*; $LabelMinistry_{ijt}$, $LabelGF_{ijt}$, $BrandNativa_{ijt}$, and $BrandBeneS_{iijt}$ are attributes of alternative *j*; $LabelMinistry_{ijt}$*Celiac, $LabelGF_{ijt}$*Celiac, $BrandNativa_{ijt}$*Celiac, and $BrandBeneS_{iijt}$*Celiac are the interaction terms of attribute levels with the participants i being celiac or not*; and ε_i is the error term.

Average willingness-to-pay (WTP) for each attribute levels was calculated as follows:

$$WTP_{(Attribute)} = -(\beta_i - \beta_{level})/\beta_1$$

Where β_1 is the parameter of price, β_{level} is the parameter for each levels of the attributes, brand and label and β_i is the parameter for reference attribute level.

5.4 Results

5.4.1 Subjects' socio-demographic characteristics

In total 244 subjects participated in the study. Table 5-2. Presents some characteristics of the respondents.

Table 5-2 Participants' socio-demographic characteristics

Characteristics	Percent of Total (%)
Gender	
Female	79.50%
Male	20.49%
Age (Median, standard deviation)	*33 years old (10.83)*
18-30	40.57%
31-50	46.72%
51-60	11.48%
Older than 60	1.23%

Education level (Median)	*University degree*
Less than middle school	0%
Middle school	4.10%
High school or equal	33.61%
University degree	58.61%
Other	3.28%
Prefer not to say	0.41%
Household income (Median)	*1.501 - 2.500 €/month*
< 600 €	2.05%
600 € - 1500 €	23.77%
1.5001- 2.500 €	25.82%
2.501 –3.500 €	20.08%
3.501 – 4.500 €	4.92%
> 4.500 €	3.69%
Prefer not to say	19.67%
Household income (Median)	*I can occasionally afford some small luxuries*
My income is not enough for necessary purchases	15.57%
I can occasionally afford some small luxuries	53.28%
I can afford everything I need	20.90%
Prefer not to say	10.25%
Background with CD	Non-celiac
Celiac	29.10%
Having a family member with CD	11.07%
Non-Celiac	59.84%

As Table 5-2 shows, the majority of participants are females since they ae responsible of the grocery shopping at home (Fieldhouse, 1995). Most of respondents have University Degree (58.61%) or a high school diploma (33.61%). Average household income was 1.501 - 2.500 €/month. In addition, incomes were also evaluated by participants. As the table suggests, approximately half of the participants declared that if they manage their incomes they would

afford occasionally some small luxuries. It is important to notice that when asked directly about their incomes, approximately 20% of participants did not prefer to respond, but the number was reduced to approximately 10% when asked about evaluating their incomes. Hence, considering the second method for estimating incomes might be more suitable for next studies.

Adherence to GFD was measured by considering the scale used by Biagi et al. (2009) and another scale designed by the authors, in order to evaluate if there is any consistency between what participants declared (authors' scale) and the scored adherence (Biagi's scale). The scored adherence was not applied to the individuals who "*don't mind about the presence of gluten in their diet*".

According to Biagi et al., (2009), from a clinical point of view, the scored adherence can be divided into three groups: 0-1 point, subjects do not follow a strict GFD; 2 points, subjects are following GFD but with mistakes and 3-4 points, subjects are following a strict GFD.

Table 5-3 Self-declared and scored adherence to GFD

		Scored adherence				
		0	1	2	3	4
Declared adherence	I don't mind the presence of gluten	35.25%	0	0	0	0
	I try to balance	7.38%	0.82%	0.41%	0	0
	I try to avoid gluten	8.20%	1.64%	0.41%	0	0.41%
	I eat only GF products	2.87%	7.79%	0.41%	13.11%	21.31%

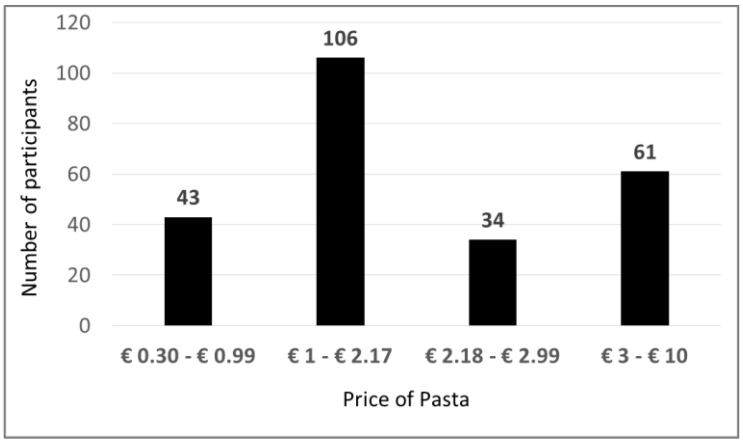
As table 5-3 presents, approximately 11% of the subjects who declared to follow a strict GFD, scored 0-1 points, suggesting that they do not follow a strict GFD. This is very important, especially for individuals who follow GFD because of health problems.

Table 5-4 Adherence to GFD

	Adherence to GFD		
	Do not follow GFD	Follow GFD with mistakes	Follow strict GFD
Number of subjects	109	102	97

However, in order to have a single scale for adherence to GFD it was considered to merge the results from the two scales. The new adherence variable has 3 levels, where 1= do not follow a GFD, 2=follow the GFD with mistakes and 3= follow a strict GFD (Table 5-4).

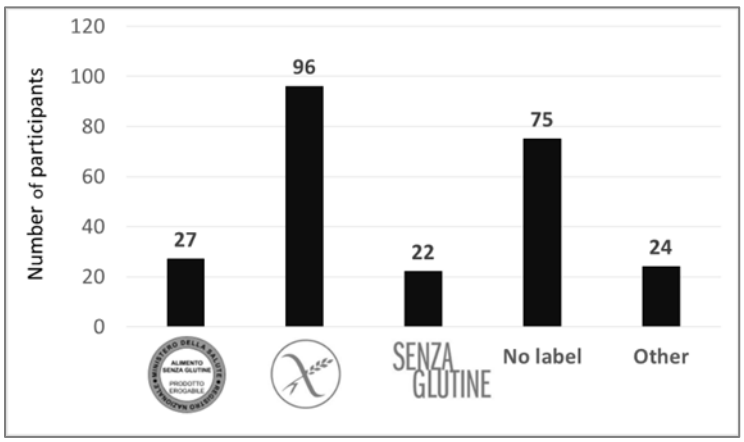
5.4.2 Characteristics of the pasta purchased by the participants



Participants were asked to describe the pasta they usually buy in terms of price, brand and label. Figure 5-2 and Figure 5-3 show the responses about price and label respectively.

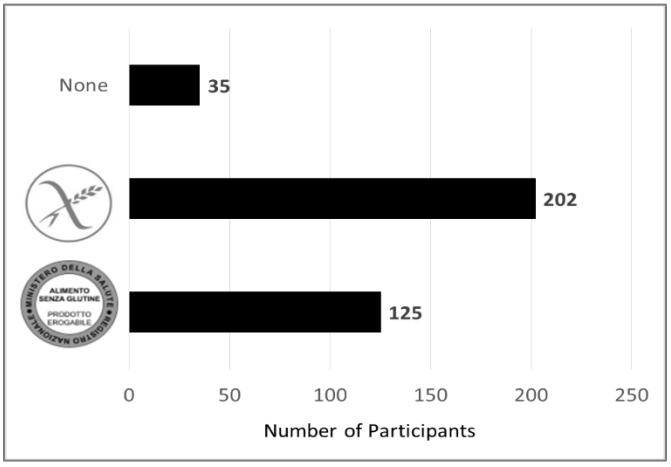
Figure 5-2 Price range for Pasta (Status Quo)

As it is observed, the minimum price for pasta is € 0.30/500 gr and the maximum is € 10/500 gr Moreover, the figure shows that most of the participants buy pasta in the price range € 1 to € 2.17 per 500 gr of pasta. Average price is €2.18/500 gr of pasta



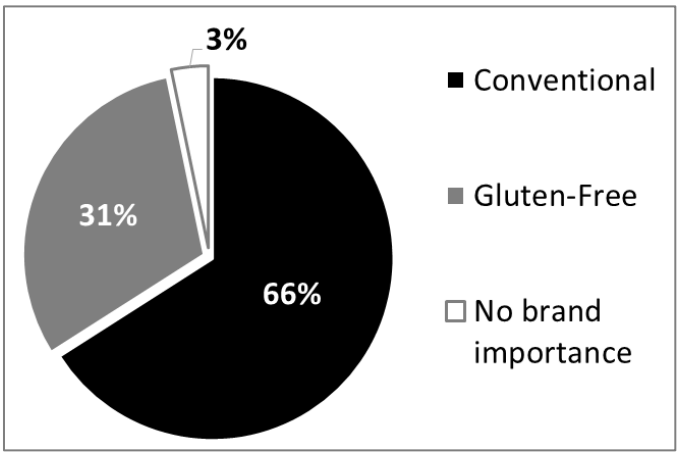
.Regarding label (figure 5-3), it is observed that most of participants buy pasta labeled by the Italian Celiac Association (ICA) or with no specific label. However, we also asked participants which label they recognize.

Figure 5-3 Labels of Pasta (Status Quo)



As figure 5-4 shows almost all the participants recognize the label of ICA and approximately half of them recognized the label of Ministry. Nevertheless, as it was previously observed, consumers rely mostly on the label of ICA.

Figure 5-4 Number of participants recognizing labels of GF products



Participants were asked also about the brand of pasta they purchase. As figure 5-5 shows most of the participants (66%) do not purchase only GF brands and for 3% of participants brand was not an important attribute. However, it is important to mention that the brand range for GF pasta was 29.

Figure 5-5 Types of pasta purchased by the participants

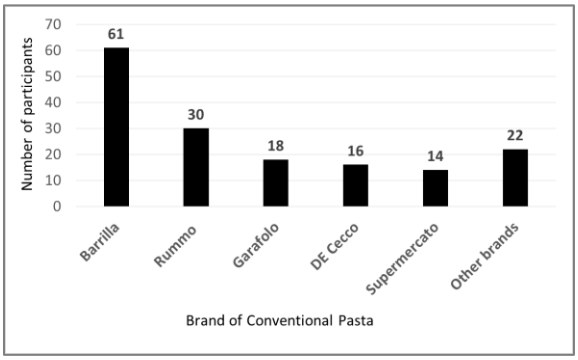


Figure 5-6 Conventional brands

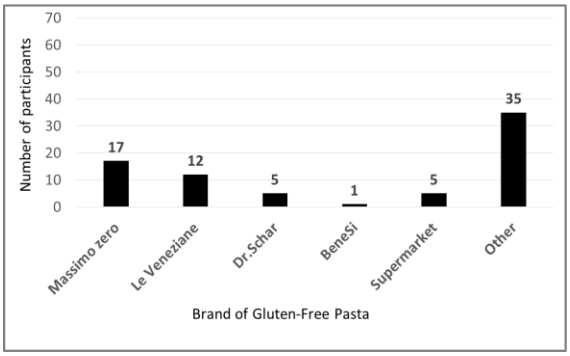


Figure 5-7 GF brands

Figure 5-6 and 5-7 show respectively the brands of conventional and GF pasta. As it is observed for conventional pasta Barrilla is the brand purchased by the majority of consumers and Massimo

Zero is GF brand mentioned mostly. Nevertheless, it is important to notice that 5 participants purchase pasta of Dr. Schär and only 1 purchases the brand BeneSi. In addition, none of the participants purchase pasta of Nativa.

5.4.3 Consumers preferences for GF pasta with Teff

The parameter estimates of the MNL and MXL models for main effect variables are listed in Table 5-5. The null hypothesis is that all coefficients are zero. As it is observed from the table, for both models, coefficients are different from zero for alternative 4; price; label of ICA and "Gluten-Free"; and brand Dr. Schar and BeneSi.

Table 5-5 Estimated parameters of MNL and RPL models

Variables	Coefficients	
	MNL	MXL
Alternative 2	0.0467	0.0420
Alternative 3	-0.0118	-0.0093
Alternative 4/Status quo	0.7187***	0.7451***
Price	-0.6350***	-0.6316***
Attribute Label		
Italian Celiac Association[a]	0.0657*	0.0520*
Ministry	0.0594	0.0795
Written "Gluten-free"	-0.1251*	-0.1315*
Attribute Brand		
Dr. Schar[a]	-0.1364#	-0.1433#
Nativa	0.0429	0.0468
BeneSi	0.0935#	0.0965#
Differences between celiac and non-celiac		
Price * Celiac Group	0.1571**	0.1551**
Attribute Label		
Italian Celiac Association * Celiac Group[a]	0.0460	0.0480
Ministry * Celiac Group	-0.0342	-0.0349
Written "Gluten-free" * Celiac Group	-0.0118	-0.0131
Attribute Brand		

Dr. Schar * Celiac Group[a]	0.2464	0.2511
Nativa * Celiac Group	-0.1199	-0.1232
BeneSi * Celiac Group	-0.1265	-0.1279
Standard Deviation		
Attribute Label		
Ministry		0.0157
Written "Gluten-free"		0.2036
Attribute Brand		
Nativa		0.0732
BeneSi		-0.0093
Log likelihood	**-2691.8**	**-2689.7**
Chisq	**508**	**528.52**
McFadden's pseudo R^2	**0.08874**	**0.089459**

*Note: *, ** and *** significant at the 0.10, 0.05, and 0.01 level, respectively.*
[a] are the reference levels of the attributes, the coefficients was calculated by:
coefficient (ref.lev.) = -Σ coefficients (attribute levels)

Coefficient for alternative 4 is positive, meaning that participants do not prefer to change their purchase habits. Moreover, as it was expected, the price's coefficient is negative. The coefficient of the written "Glute-Free" is least preferred by the participants. However, participants have a positive preference for the label of ICA. Furthermore, for 10% significance, results suggest that brand is considered relevant attribute by the participants where Dr. Schär is less preferred compared to BeneSi.

Finally, comparisons between celiac and non-celiac participants suggest that price is the most important attribute and for celiac subjects the coefficient is positive meaning that pasta with a higher price has a better quality.

In addition, the parameters of standard deviation are zero, meaning that there is a homogeneity in the subjects regarding preferences for label and brand.

However, we considered that incomes may influence the creation of different classes among participants. Hence, a latent class analysis was applied considering incomes and finding out differences between celiac and non-celiac population. Results are shown in table 5-6.

Table 5-6 . Estimated parameters of LCM

Variables	Coefficients			
	Class 1	Class 2	Class 3	Class 4
Sample Share	*(39%)*	*(4%)*	*(53%)*	*(14%)*
Price	-24.855***	-1.184***	-1.036***	0.390***
Attribute Label				
Italian Celiac Association[a]	0.216	-0.144	0.164**	-0.160
Ministry	0.057	-0.103	0.041	0.210
Written "Gluten-free"	-0.273	0.247	-0.205**	-0.050
Attribute Brand				
Dr.Schar[a]	-0.109	2.137*	-0.373***	-0.214**
Nativa	0.107	-0.297	0.016	0.404**
BeneSi	0.002	-1.840*	0.357***	-0.190
Differences between celiac and non-celiac				
Price * Celiac Group	-105.03	-0.373	0.781***	1.401***
Attribute Label				
Italian Celiac Association * Celiac Group[a]	3.647	0.360	-0.021	0.190
Ministry * Celiac Group	-3.921	-0.114	0.023	-0.260
Written "Gluten-free" * Celiac Group	0.274	-0.246	-0.002	0.070
Attribute Brand				
Dr. Schar * Celiac Group[a]	74.741	1.090	0.193[#]	0.357
Nativa * Celiac Group	-25.748	-0.676	-0.001	-0.275
BeneSi * Celiac Group	-48.993	-0.414	-0.192[#]	-0.082

*Note: *, ** and *** significant at the 0.10, 0.05, and 0.01 level, respectively.*
[a] are the reference levels of the attributes, the coefficients was calculated by:
coefficient (ref.lev.) = -Σ coefficients (attribute levels)

As it is observed, price is an important attribute for all the classes, but for class 4 the coefficient has a positive sign meaning that participants relate the higher price with a better-quality product.

Regarding comparisons between celiac and non-celiac subjects, results show that for class 1 and 2 price is not considered important. This is in line with the results from the qualitative study, which showed that celiac subjects think that GF products are expensive, but since they receive the "voucher" it does not weight their pocket. Nevertheless, class 3 and 4 consider it as relevant and the positive sign, as in the previous case, it is considered as an attribute of a better quality.

Regarding attribute label, class 3 considers it as relevant, where label of ICA is preferred and the label "Gluten-Free" is not. However, when comparing celiac and non-celiac participants, this attribute is not considered as affecting celiac participants preferences.

Regarding attribute brand, it is not considered as affecting preferences only for class 1. As table 5-6 suggests that Dr. Schär is preferred, but class 2, but not by class 3 and 4, while brand BeneSi is preferred by class 3 but not by class 2. Finally, brand Nativa is preferred by class 4. This is a surprising fact since none of the participants in this study mentioned it as a brand they purchase.

When comparing subjects, brand is affecting preferences for class 3. As it is observed, for celiac participants in class 3, the preferred brand is Dr Schar, but BeneSi is not.

5.4.4 Average WTP for branded and labeled GF pasta with Teff

Table 5-7 Average WTP for GF pasta with Teff

Attributes	WTP_{MNL}	WTP_{LCM}			
		$WTP_{Class\ 1}$ *(39%)*	$WTP_{Class\ 2}$ *(4%)*	$WTP_{Class\ 3}$ *(53%)*	$WTP_{Class\ 4}$ *(14%)*
Ministry	-0.01	-0.01	0.03	-0.12	-0.95
Written "Gluten-free"	-0.30	-0.02	0.33	-0.36	-0.28
Ministry * Celiac Group	0.51	-0.07	1.27	-0.06	0.32
Written "Gluten-free" * Celiac Group	0.37	-0.03	1.62	-0.02	0.09
Nativa	0.28	0.01	-2.06	0.38	-1.58
BeneSi	0.36	0.00	-3.36	0.70	-0.06
Nativa * Celiac Group	2.33 (107%)	-0.96	-4.73	0.25	0.45
BeneSi * Celiac Group	2.37 (109%)	-1.18	-4.03	0.49	0.31

The average WTP for branded and labelled pasta was calculated by considering coefficients from MNL and LCM.

As table 5-7 shows, for the MNL model (1 class model), products carrying label of the Ministry of Health and the claim "GF" have a negative WTP, meaning that they should cost less than products carrying the label of ICA. This is similar for the classes 1, 3 and 4. Furthermore, as it is observed, only celiac participants in the MNL are willing to pay a premium price for brand Nativa and BeneSi.

By considering the results from table 5-7 products of Dr Schär and labeled by the ICA are generally more preferred by the participants, since mostly participants are not willing to pay a premium price for other products.

5.5 Discussion

The market of GF products is expanding rapidly in the recent years due to the increasing number of people suffering from CD and due to the increasing popularity of the GFD. However, to date research has found that GFD is suitable for some health conditions but has not found that is a healthier diet option.

Nevertheless, since the market is expanding it is important to understand consumers' preferences for GF products. This would support the companies which are already operating in the GF market and other companies which plan to enter the market in the future. However, to date research on this topic is limited. Hence, the main objective of this study was to evaluate the preferences of GF product by considering not only celiac patients, who are obliged to buy GF products, but also non-celiac people who voluntarily follow the diet or might buy GF products in the future.

We found that in general consumers are not willing to give up on their habitual pasta product. Generally, consumers buy pasta on the price range of €1 to €2.17 and the average purchase price is € 2.18/500 gr of pasta. Moreover, regarding brand only 8 participants were buying pasta of Dr Schär and 1 from BeneSi. In addition, label of ICA was recognized by the majority of respondents in the study. Results of choice experiment show that brand and label are considered important for participants in this study. The majority of the participants prefer the ICA's label over the GF claim. However, for celiac people, for the one class model and also for the 4 class model, label was not considered as important. This is in line with results from the qualitative study, which

found that celiac people read the list of the ingredients and do not rely only on the labels communicating the absence of gluten. In addition, Dr Schär is less preferred over BeneSi, the brand of retailer Coop. However, when comparing non-celiac and celiac participants, for the latter group Dr Schär is the preferred one over the brand BeneSi. This might be due to the fact that Dr Schär is one of the first specialized brands on GF products and probably celiac consumers recognize it and rely on it.

Regarding the average WTP for GF pasta with teff, this study found that celiac participants, when considering the whole sample, are willing to pay a premium price of 7% for Nativa brand and 9% for the BeneSi. This results are in line with the outcomes from the qualitative study, which found that, even though Dr Schär is the most recognized brand among celiac participants, they are always willing to try new brands and products. Moreover, this study found that participants are not willing to pay a premium price for GF products carrying GF label,. This is in line with findings from other studies, which have shown that label did not significantly influence the non-celiac consumers' WTP (De-Magistris, Xhakollari, De, & Rios, 2015; de Magistris, Belarbi, & Hellali, 2017; de Magistris, Xhakollari, & Munoz, 2015).

Nevertheless, this is the first study, which has applied a discrete choice experiment for identifying preferences for GF products and research on this topic is very limited. Thus, future research should carefully consider the appropriate methodological techniques to use when studying attributes and WTP for GF products in order to provide with adequate support firms that operate in the GF market so they would better meet consumers' requirements. Furthermore, taste is an important attribute which should be considered carefully by the incoming research, since it is one of the attribute which GF products suffer the most. Finally, nutritional aspects should also be taken into account in the future. These two attributes might impact strongly preferences for GF products.

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Chapter 6

Summary and Concluding Remarks

This study presents an investigation of the gluten-free (GF) phenomenon. It deals with concerns regarding adherence to the gluten-free diet (GFD) and preferences for GF products. It aims to understand factors affecting adherence to GFD and discern most important attributes which affects preferences for GF products by considering celiac and non-celiac people, followers and non-followers of the diet.

Firstly, a review on factors affecting adherence to GFD and preferences for GF products was carried out in order to understand the general problematic of the topic.

Chapter 2 gives an important contribution to the literature, since the last systematic review on factors affecting adherence to GFD was performed in 2007. Furthermore, to date, no review has been realized for non-celiac consumers. Hence, we considered studies dealing with adults, celiac and non-celiac, published from January 2008 to September 2017. After a search on scientific databases, 54 articles were considered for the review. We found out that most of the research focuses on celiac consumers and is conducted mainly in the North American countries and Europe. These regions have the highest number of people affected by celiac disease (CD). Moreover, we found that research on economic aspects of the diet is very limited. After analyzing results from the studies and the problematics they dealt with, we identified 8 factors which affect adherence to GFD:

- Factors of the aspects of GFD
- Socio-demographic factors
- GF products' factors
- Psychological Factors
- Symptoms related to Celiac
- Celiac Disease's factors
- Quality of Life
- Other Factors

Furthermore, the systematic review aimed to discern differences between celiac and non-celiac people following GFD. However, since the number of studies on non-celiac people was very

limited, it was not possible to give precise conclusions on the differences between them and celiac people.

Since research on GF products and economic aspects of the diet is very limited, a qualitative study aiming to understand consumers' experience when buying GF products was performed (Chapter 3). Semi structured interviews were conducted with consumers, celiac and non-celiac, three retailers and a rapresentative of Italian Association of Celiac (ICA). These different actors were approached in order to understand if there are dissimilarities between them. The retailers explained the general supply for GF products and gave perspectives on the future of GF products. The interview with the rapresentative of ICA, helped us to understand how the GF products have evolved in the last years and what are some of the concerns that celiac people still face in terms of prices, availability and nutritional aspects, in order to learn about the past problematics of the GF products and point out some future perspectives of this category of food.

Retailers and the representative of ICA declared that the supply for GF products has improved a lot in the last decade. However, concerns regarding nutritional aspects emerged. Furthermore, when asked about the reasons why nowadays many non-celiac people voluntarily follow the diet, they agreed on the fact that generally they are not well-informed and are affected by the web and famous non-celiac celebrities who follow the diet.

On the other hand, consumers declared that the supply for GF products is good, but they expressed concerns about sensorial aspects of the GF products, especially taste and texture. However, dissimilarities emerged between celiac and non-celiac participants. The latter group considers GF products as healthy and declared improvements of their digestive system when starting the diet. They did not comment about the availability nor nutritional aspects of the products. However, they consider GF products as expensive. Contrary to this, celiac people and family members of celiacs declared that even though the supply of GF products has improved a lot in terms of availability, nutritional and sensorial aspects do not fully meet their requirements, especially for bread and snacks. In addition, this group recognized that prices of GF products are high. However, this is not a concern for them since they are provided with monthly vouchers that cover GF food expenses.

Finally, participants agreed on the fact that pasta is one of the best GF products and it is very similar to the conventional one in terms of texture and taste. However, bread is considered one of the least preferred in terms of sensorial characteristics.

Subsequently the research was developed in two steps, at first an empirical research was conducted aiming to model behavior (adherence) towards GFD and understand factors affecting celiac and non-celiac people following GFD. Subsequently, the second stage consisted of another empirical study that intended to understand consumers' preferences and willingness to pay (WTP) for GF pasta

Chapter 4 aims to understand which are the most important factors affecting adherence to GFD. We approached the analysis by considering health beaviour model, Integrative Model (IM) and Multi Theory Model (MTM). To date, IM has been considered by many studies and have given robust results in explaining the behaviour. However, MTM is a new theory which is based on previous theories, but it states that the intentions to perform a certain behaviour depend firstly on the intention to start the behaviour and the intentions to continue it. Both models were applied with italian subjects, followers and non followers of the diet, celiac and non-celiac people. Constructs of the model were designed in accordance with the findings of the systematic review.

Results show that adherence to GFD is affected mainly by:

- Attitudes towards GFD
- Self-efficacy
- Injunctive norms
- Knowledge about GFD
- Perceptions that GF products are expensive.

Moreover, we found that intentions to start following GFD among non-followers of the diet increased for the ones that believe that people who follow a GFD have a healthier diet and are more active compared to the ones that don't. This is in line with the general beliefs about the GFD but to date these beliefs have not been scientifically proven.

To date, quality of life (QOL) and depression and anxiety levels have been taken into account by a lot of studies on the adherence to GFD. They suggested that people who follow GFD suffer from high levels of depression and anxiety and low scores of QOL. However, we did not find statistically

significant differences between followers and non-followers of the diet. This is in line with another study, which to the best of our knowledge is the only one that have compared followers and non-followers of the GFD.

Regarding the health behavior models, we found that constructs of the IM explain the adherence to GFD. However, regarding the MTM, constructs of the continuation model did not explain adherence to GFD, but we found that intentions to start following the GFD depend on attitudes towards it. Nevertheless, other studies have found that MTM is a good predictor for measuring intentions to start and continue the behaviour. Still, it is important to stress the fact that in this research, for the continuation model, we measured the actual behaviour (adherence to GFD) and for the initiation model the intention to start the behaviour (initiating the GFD). Thus, it might be that MTM is a good predictor for measuring intentions about a certain behavior and further improvements should be made in terms of measuring the actual behavior.

Finally, since we found out that economic aspects of the GF products have not been widely analyzed by the research, we focused our attention on the consumers' WTP. We compared celiac to non-celiac-participants. The results showed that for non-celiac people high levels of GFD increases the WTP for GF pasta with teff.

Thus, the second stage of the research was about understanding preferences for GF pasta with teff. The aim was to create a similar purchase environment. Thus, a choice experiment was designed by considering price, brand and label. Participants were asked to choose between 4 alternatives of pasta. The fourth alternative was the pasta they usually buy, retrieved from a previous question they responded to. Moreover, since GF products are considered as expensive, we applied a latent class model (LCM) that groups the sample in similar classes by both the individual choices and considering specific characteristics. We compared results from LCM with results from multinomial logit, which is considered as a single class model. Furthermore, we assumed that preferences for GF products are also affected by the fact that one is obliged to consume these products, in our case are celiac people. In order to achieve this, we applied interaction terms between attribute levels and the fact if a person was celiac or not.

Later, we found that in general consumers are not willing to give up on their habitual pasta product. Results of choice experiment show that brand and label are considered important for participants in this study. Most of the participants prefer the ICA's label over the GF claim.

However, for celiac people, for the one class model as well as for the 4-class model, label was not considered as important. This is in line with results from the qualitative study, which found that celiac people read the list of the ingredients and do not rely only on the labels communicating the absence of gluten. In addition, Dr Schär is less preferred over BeneSi, the retailer brand Coop. However, when comparing non-celiac and celiac participants, for the latter group Dr Schär is the preferred one over the brand BeneSi. This might be due to the fact that Dr Schär is one of the first specialized brands on GF products and probably celiac consumers recognize it and rely on it.

Regarding the average WTP for GF pasta with teff, when considering the whole sample, celiac participants are willing to pay a premium price of 7% for Nativa brand and 9% for the BeneSi. These results are in line with the outcomes from the qualitative study, which found that, even though Dr Schär is the most recognized brand among celiac participants, they are always willing to try new brands and products. Moreover, this study found that participants are not willing to pay a premium price for GF products carrying GF label. This is in line with findings from other studies, which have shown that label did not significantly influence the non-celiac consumers' WTP

At the best of our knowledge, this is the first study that has applied a discrete choice experiment for identifying preferences for GF products and research on this topic is very limited. Thus, future research should carefully consider the appropriate methodological techniques to use when studying attributes and WTP for GF products in order to provide with adequate support firms that operate in the GF market, so they could better meet consumers' requirements. Furthermore, taste is an important attribute which should be considered carefully by the coming research, since it is one of the attributes for which consumers complain mostly, especially bread. Hence, one way to apply this is by considering how taste would affect consumers' utility and choices about a given GF product. Finally, nutritional aspects should also be taken into account in the future. It is relevant to study how the information on nutritional properties would change the buying behavior, especially to those people who voluntarily follow the diet.

6.1 Concluding remarks

GFD and GF products are becoming very popular in the last years. The number of celiac people is increasing, and also non-celiac people are following GFD and buying GF products. Subsequently

the GF market is expanding. However, research on this topic has not found that GFD is healthier diet option for the general population. Hence, the first aim of this research was to understand behavior towards GFD. We compared two theories on health behavior, IM and MTM. IM claims that it has overpassed the limitations of other theories which consider intentions and suggests that the real behavior is a product of intentions, which are affected mainly by attitudes, norms and self-efficacy, and other background factors. Results of this study confirmed the theoretical frame of the model. However, MTM is one of the newest theories in the health behavior models. It was particularly relevant to the present study since according to this theory, behavior is composed by two important moments, the initiation and the continuation of the behavior. However, the results confirmed only the first part of the behavior (intentions to start the GFD) but not the second part (continuation of the diet). Hence, the approach of MTM to study the behavior by considering two relevant moments, fits to our problem (explaining adherence to GFD), but it does not seem to explain the real behavior. Hence, in our opinion there is a behavioral gap between intentions and the real behavior, for which IM seems to have already overcome this issue. Thus, it is important that further improvements be made on MTM theory.

Moreover, we found that non-celiac people believe some myths which are not scientifically proven. Thus, it is crucial to provide them with a clear information about the true effects of the diet. In addition, it is necessary to inform catering services about the high risks that the contaminated food has on celiac-people. This was a concern raised by the celiac people who participated in the qualitative study. To further support this, the study found that adherence is affected directly by knowledge and believes that people have about the diet. Hence, it is necessary for consumers that before engaging in a behavior which affects their health, require information from health professionals. By considering these results, it is important that policy makers should carefully consider the non-celiac population that follows GFD for which research has not found that it is suitable as long as they do not suffer from any specific health condition. It is important to provide them with the necessary information about the side effects of the diet and the relevance it has for the people who follow it due to health conditions. This is especially necessary, considering that many celiac people, as showed in this study, complain about the fact that the disease, in some cases, is not taken seriously, especially by the catering services, which in some occasions offer contaminated food. Hence, more specific policies should be addressed towards non-celiac people and catering services.

In addition, the economic aspects have not been broadly studied. However, this is essential for companies that operate in the GF market. Important improvements should be made on GF products, especially in terms of nutritional aspects and taste. Moreover, considering the profile of the potential consumers is a necessary to be taken into account from managers. As it was shown, the recent trends of non-celiac following a GFD are seen as temporary. Hence, managers of the companies offering GF products should consider this aspect carefully when deciding to enter the market. Nevertheless, statistics consider that the number of celiac is increasing worldwide, but it is important to understand if celiac consumers will continue to consume processed GF products or will switch to the natural GF products. This aspect should be considered thoroughly by companies operating in the GF market.

Finally, this research studied for the first times how preferences for GF products differ between celiac and non-celiac consumers. Thus, it is crucial that future research takes into account these preferences.

6.2 Limitations

The present study bears some limitations in terms of sample representativeness, measurement of adherence to GFD and the choice experiment.

Most of the participants in this study were females and the average age was 39 years old. These characteristics are not in accordance with the Italian Census of 2011. Hence, the descriptive results of this study should not be extrapolated to the general population in Italy.

However, it is necessary to underline the fact that CD has high prevalence among females, and they are, in most of the occasions, responsible for grocery shopping at home.

Adherence to GFD was measured through direct and indirect questions. In some studies adherence to GFD was measured through clinical analysis. However, many studies have utilized the self-declare adherence, as in this case. Moreover, the scale utilized have been used in other studies in Italy.

Hypothetical choice experiment, applied in this study, bears some biasis. However, studies have shown that cheap talks might lower the biasis. Another dispute regarding hypothetical and real choice experiments is the possibility of an increase of “non-buying option” in the latter case.

However, we tried to improve this limitation, by not considering a “non-buying option” but a status quo, because all participants were buying pasta.

Supplementary material

7.1 Summary of the studies of the review

	Celiacs																										
	Kautto et al. (2017)*#	Leffler et al. (2017)*#	Muhammad et al. (2017)	Borghini et al. (2016)*	Kautto et al. (2016)	Oza et al. (2016)	Rocha et al. (2016)*#	Rodríguez-Almagro et al. (2016)	Silvester et al. (2016)*	Casellas et al. (2015)	Castilhos et al. (2015)	Corposanto et al. (2015)	Ferster et al. (2015)*	Mahadev et al. (2015)	Rajpoot et al. (2015)	Sainsbury et al. (2015b)	Sainsbury et al. (2015a)	Villafuerte-Galvez et al. (2015)	Bagolin do Nascimento et al. (2014)	Dowd et al. (2014)*#	Rose & Howard. (2014)*#	Barratt et al. (2013)	Kurppa et al. (2013)	Mahadev et al. (2013)*	Paarlahti et al. (2013)	Sainsbury et al. (2013)	Sainsbury et al. (2013b)
Transgression/Adherence		x	x	x		x		x	x	x	x	x	x	x	x	x		x	x	x		x	x	x		x	+ +
Time in GFD				x				ax	x		xa	x				+	x	x					x		x	x	x[1]
Perceptions of GFD																	x	+						x		+	
Knowledge			x				x		x				x		+			+								+	
Nutrients																											
Initiation																											
Information source									x																		
SDE																											
Intention																+										+	
Age	x			x	x	a		ax	x		xa	x						x	x				+	x	x	+	x[1]
Age at diagnosis																		x	x				+			+	x[1]
BMI															x					x				x			
City of residence/ population																											
Education									x			x						+	x					x		+	
Gender	x			x	x			ax	x			x						x	x				x	x		+	x
Household members												x															
Income						a					xa	x						x	x								
Marital status												x						x	x								
Race			+																								
Shopper									x																		
Smokers/non-smokers																							x				
State of Employment												x															

(continued on next p

continued)

	Celiacs																										
	Kautto et al. (2017)*#	Leffler et al. (2017)*#	Muhammad et al. (2017)	Borghini et al. (2016)*	Kautto et al. (2016)	Oza et al. (2016)	Rocha et al. (2016)*#	Rodríguez-Almagro et al. (2016)	Silvester et al. (2016)*	Casellas et al. (2015)	Castilhos et al. (2015)	Corposanto et al. (2015)	Ferster et al. (2015)*	Mahadev et al. (2015)	Rajpoot et al. (2015)	Sainsbury et al. (2015b)	Sainsbury et al. (2015a)	Villafuerte-Galvez et al. (2015)	Bagolin do Nascimento et al. (2014)	Dowd et al. (2014)*#	Rose & Howard. (2014)*#	Barratt et al. (2013)	Kurppa et al. (2013)	Mahadev et al. (2013)*	Paarlahti et al. (2013)	Sainsbury et al. (2013)	Sainsbury et al. (2013b)
Villingness to Pay																											
ntention to buy																											
Availability		x											x		x				x								
Label		x	+										x														
Organoleptic attributes			+										x						x								
Price			x										x		x				x								
Variety																			x								
Acceptance				x										x			x				x						+
Anger				x										x			x				x						
Anxiety/Fear		x		x			x							x			x									+	+[2]
Curiosity				x										x			x										
Confused				x										x			x										
Conscientiousness				x										x			x										
Denial				x										x			x				x						+
Depression				x			x							x			x				x					+	+
Desperation/Grief				x										x			x			x	x						
Disengagement				x										x			x										+
Eating disorder				x										x			x									+	+
Frustration				x										x			x										
Guilt				x			x							x			x										+
Mood				x										x			x										
Overwhelmed				x										x			x										

(continued)

	Celiacs																										
	Kautto et al. (2017)*#	Leffler et al. (2017)*#	Muhammad et al. (2017)	Borghini et al. (2016)*	Kautto et al. (2016)	Oza et al. (2016)	Rocha et al. (2016)*#	Rodríguez-Almagro et al. (2016)	Silvester et al. (2016)*	Casellas et al. (2015)	Castilhos et al. (2015)	Corposanto et al. (2015)	Ferster et al. (2015)*	Mahadev et al. (2015)	Rajpoot et al. (2015)	Sainsbury et al. (2015b)	Sainsbury et al. (2015a)	Villafuerte-Galvez et al. (2015)	Bagolin do Nascimento et al. (2014)	Dowd et al. (2014)*#	Rose & Howard. (2014)*#	Barratt et al. (2013)	Kurppa et al. (2013)	Mahadev et al. (2013)*	Paarlahti et al. (2013)	Sainsbury et al. (2013)	Sainsbury et al. (2013b)
Personality changes				x	x									x			x										
Pleasure in eating				x										x			x										
Relief				x										x			x										
Stress				x										x			x										+
Values trait				x										x			x										
Venting				x										x			x										x
Behavioural belief																											
Control beliefs																											
Normative belief																											
Perceived behavioural control																+										+	+
Social norms	x																										
Subjective norm																										x	
Anaemia																								x			
Ataxia																											
Attentional deficit																											
Carpal tunnel syndrome																											
Dermatitis																											
Diabetes mellitus, type I																							x				
ETCL																											
Fatigue																								x			
Gastrointestinal QOL																							x		x		+
Gastrointestinal neoplasia																											
Hypothyroidism/Thyroids																							x				
(IgA) deficiency																											

	Celiacs																										
	Kautto et al. (2017)*#	Leffler et al. (2017)*#	Muhammad et al. (2017)	Borghini et al. (2016)*	Kautto et al. (2016)	Oza et al. (2016)	Rocha et al. (2016)*#	Rodríguez-Almagro et al. (2016)	Silvester et al. (2016)*	Casellas et al. (2015)	Castilhos et al. (2015)	Corposanto et al. (2015)	Ferster et al. (2015)*	Mahadev et al. (2015)	Rajpoot et al. (2015)	Sainsbury et al. (2015b)	Sainsbury et al. (2015a)	Villafuerte-Galvez et al. (2015)	Bagolin do Nascimento et al.	Dowd et al. (2014)*#	Rose & Howard. (2014)*#	Barratt et al. (2013)	Kurppa et al. (2013)	Mahadev et al. (2013)*	Paarlahti et al. (2013)	Sainsbury et al. (2013)	Sainsbury et al. (2013b)
rritable bowel syndrome																						+					
Migraine																						x					
Mouth ulcers																						x					
Myocardial Infarction																											
NCGS symptoms																											
Osteoporosis																							x	x			
Other food allergies																			x				x		x		+
Other autoimmune disorders																											
Pruritus																						+					
Raynaud's phenomenon																											
Rheumatoid arthritis																											
Sleeping issues		x																				x					
Vestibular disturbance																											
Level of CD symptoms		x				xa								+									x	x	x	x	
Diagnosis time																			x								
CD in family history																							x				
Perceptions of CD																											
Level of CD symptoms		x				xa								+									x	x	x	x	
Coping strategies					x		x			+	a						x								x	+	+
Doctors' support			+						x	+	a	x	x		x									x	x		+
Family relations/support							x			+	a														x		
General Health										+	a														x		
Health perception						a		ax		+	a									x					x		
Physical conditions										+	a														x		

		Kautto et al. (2017)*#	Leffler et al. (2017)*#	Muhammad et al. (2017)	Borghini et al. (2016)*	Kautto et al. (2016)	Oza et al. (2016)	Rocha et al. (2016)*#	Rodríguez-Almagro et al. (2016)	Silvester et al. (2016)*	Casellas et al. (2015)	Castilhos et al. (2015)	Corpos ante to et al. (2015)	Ferster et al. (2015)*	Mahadev et al. (2015)	Rajpoot et al. (2015)	Sainsbury et al. (2015b)	Sainsbury et al. (2015a)	Villafuerte-Galvez et al. (2015)	Bagolin do Nascimento et al. (2014)	Dowd et al. (2014)*#	Rose & Howard. (2014)*#	Barratt et al. (2013)	Kurppa et al. (2013)	Mahadev et al. (2013)*	Paarlahti et al. (2013)	Sainsbury et al. (2013)	Sainsbury et al. (2012b)
Celiacs	Social activities		x								+	a															
	Social Isolation		x		x			x			+	a	x					x									
	Self-efficacy										+	a					+										
	Vitality										+	a															
	Celiac vs not																										
	Eating problems									x			x														
	Eating habits																	x									
	Emotional support			+																							
	Members of association								x																		
	Mental health																										
	Self restraint																										
	Shape concerns																										
	Substance use																										
	Weight matters																										
	Where to buy																										
	Where to eat	x												x	x			x									

	Celiacs															NCGS	Celiacs vs Non Celiacs									Non Celiacs		Par
	Van Hees et al. (2013)*	Zarkadas et al. (2013)*	Ford et al. (2012)	Ukkola et al. (2012)*	Arigo et al. (2012)	Araújo & Araújo (2011)*	Sainsbury & Mullan (2011)	Bürk et al. (2009)	Edwards George et al. (2009)	Hopman et al. (2009)	Leffler et al. (2009)	Tursi et al. (2009)	Casellas et al. (2008)	Leffler et al. (2008)	Biesiekierski et al. (2014)	Peters et al. (2014)	Verrill et al. (2013) (CD)	Verrill et al. (2013) (GS)	Silvester et al. (2016)	Shah et al. (2014)	Barratt et al. (2011)*	Ukkola et al. (2011)*	De Magistris et al. (2015)°	De-Magistris et al. (2015)°	Lis et al. (2015)*	De Magistris et al. (2017)°	Bacigalupe & Plocha. (2015)
Transgression/Adherence	x	x	x	x	x	x	x		x	x	x	x		x	x	x	x	x	x	x	x	x						x
Time in GFD	x	x							x	+	+	x		x	+	x	+	x	x									
Perceptions of GFD					x		+				+			+						+	x	x			x			x
Knowledge							x							+	x			x										
Nutrients			x																									
Initiation															x										x			
information source																		x	x						x			
SDE											x																	
Intention							+																					
Age										+	x	x	+	x			x		x	x	x	x			x			
Age at diagnosis									x	+	x		a	x						x								
BMI										x																		
City of residence/ population													a															
Education				x					x			a		a	x		x	x		x	x							
Gender				x	x				x	+	x		a	x			+	x	x	x	x				x			
Household members																												
Income																				+	x							
Marital status				x					x				a	+							x	x						
Race									x								x	x	x	x								
Shopper																												
Smokers/non smokers													a															

State of Employment				x					x				a	x						+		x			x		
	Celiacs														NCGS		Celiacs vs Non Celiacs						Non Celiacs				Par
	Van Hees et al. (2013)*	Zarkadas et al. (2013)*	Ford et al. (2012)	Ukkola et al. (2012)*	Arigo et al. (2012)	Araújo & Araújo (2011)*	Sainsbury & Mullan (2011)	Bürk et al. (2009)	Edwards George et al. (2009)	Hopman et al. (2009)	Leffler et al. (2009)	Tursi et al. (2009)	Casellas et al. (2008)	Leffler et al. (2008)	Biesiekierski et al. (2014)	Peters et al. (2014)	Verrill et al. (2013) (CD)	Verrill et al. (2013) (GS)	Silvester et al. (2016)	Shah et al. (2014)	Barratt et al. (2011)*	Ukkola et al. (2011)*	De Magistris et al. (2015)°	De-Magistris et al. (2015)°	Lis et al. (2015)*	De Magistris et al. (2017)°	Bacigalupe & Plocha. (2015)
Willingness to Pay																							x	x			
Intention to buy																										x	
Availability		x	x						x																		
Label		x	x														+	x					x				
Organoleptic attributes		x																					x	x			
Price		x	x						x					+													x
Variety																											
Acceptance		x												x													
Anger		x												x		x											
Anxiety/Fear	x	x	x											x		x					x	x					
Curiosity														x		x											
Confused		x												x													
Conscientiousness									+					x													
Denial														x													
Depression	x		x			+		x					x	x		+					x	x					
Desperation/Grief		x												x													
Disengagement														x													
Eating disorder						+								x													
Frustration		x												x													
Guilt														x													
Mood														x													
Overwhelmed		x												x													
Personality changes								x						x													
Pleasure in eating														x													

Relief		x												x													
	Celiacs														NCGS		Celiacs vs Non Celiacs						Non Celiacs				Par
	Van Hees et al. (2013)*	Zarkadas et al. (2013)*	Ford et al. (2012)	Ukkola et al. (2012)*	Arigo et al. (2012)	Araújo & Araújo (2011)*	Sainsbury & Mullan (2011)	Bürk et al. (2009)	Edwards George et al. (2009)	Hopman et al. (2009)	Leffler et al. (2009)	Tursi et al. (2009)	Casellas et al. (2008)	Leffler et al. (2008)	Biesiekierski et al. (2014)	Peters et al. (2014)	Verrill et al. (2013) (CD)	Verrill et al. (2013) (GS)	Silvester et al. (2016)	Shah et al. (2014)	Barratt et al. (2011)*	Ukkola et al. (2011)*	De Magistris et al. (2015)°	De-Magistris et al. (2015)°	Lis et al. (2015)*	De Magistris et al. (2017)°	Bacigalupe & Plocha. (2015)
Stress						+								x													
Values trait									+					x													
Venting														x													
Behavioural belief							+																				
Control beliefs							+																				
Normative belief							x																				
Perceived behavioural control							+																				
Social norms																											
Subjective norm							x																				
Anaemia																											
Ataxia								x																			
Attentional deficit								x																			
Carpal tunnel syndrome								x																			
Dermatitis										x		x															
Diabetes mellitus, type I	x								x	x	x		a							x							
ETCL												x															
Fatigue															x												
Gastrointestinal QOL										x			x												x		
Gastrointestinal neoplasia												x															
Hypothyroidism/Thyroids									x	x	x		a														
(IgA) deficiency								x		x			a														
Irritable bowl syndrome															x										x		
Migraine								x							x												
Mouth Ulcers																											

Myocardial Infarction	x											x															
	Celiacs														NCGS		Celiacs vs Non Celiacs						Non Celiacs				Par
	Van Hees et al. (2013)*	Zarkadas et al. (2013)*	Ford et al. (2012)	Ukkola et al. (2012)*	Arigo et al. (2012)	Araújo & Araújo (2011)*	Sainsbury & Mullan (2011)	Bürk et al. (2009)	Edwards George et al. (2009)	Hopman et al. (2009)	Leffler et al. (2009)	Tursi et al. (2009)	Casellas et al. (2008)	Leffler et al. (2008)	Biesiekierski et al. (2014)	Peters et al. (2014)	Verrill et al. (2013) (CD)	Verrill et al. (2013) (GS)	Silvester et al. (2016)	Shah et al. (2014)	Barratt et al. (2011)*	Ukkola et al. (2011)*	De Magistris et al. (2015)°	De-Magistris et al. (2015)°	Lis et al. (2015)*	De Magistris et al. (2017)°	Bacigalupe & Plocha. (2015)
Osteoporosis	x																										
Other food allergies									+					+	x												
Other autoimmune disorders														x													
Pruritus															x												
Raynaud's phenomenon											x																
Rheumatoid arthritis	x												a														
Sleeping issues																											
Vestibular disturbance								x																			
Level of CD symptoms					x	x			+			x	a							+		x					
Diagnosis time																											
CD in family history								x									x	x	x						x		
Perceptions of CD				+	x														x								
Level of CD symptoms					x		+						x									x					x
Coping strategies					x		+		x	x			x		x		x	x		x					x		x
Doctors' support					x		+						x				+	+									x
Family relations/support					x	x	+						x														
General Health					x		+						x				+	+				x					
Health perception					x	x	+						x														
Physical conditions					x	x	+						x														x
Social activities		x			x		+						x	x							x						x
Social Isolation				x	x		+						x														
Self efficacy					x	+	+						x														

	Van Hees et al. (2013)*	Zarkadas et al. (2013)*	Ford et al. (2012)	Ukkola et al. (2012)*	Arigo et al. (2012)	Araújo & Araújo (2011)*	Sainsbury & Mullan (2011)	Bürk et al. (2009)	Edwards George et al. (2009)	Hopman et al. (2009)	Leffler et al. (2009)	Tursi et al. (2009)	Casellas et al. (2008)	Leffler et al. (2008)	Biesiekierski et al. (2014)	Peters et al. (2014)	Verrill et al. (2013) (CD)	Verrill et al. (2013) (GS)	Silvester et al. (2016)	Shah et al. (2014)	Barratt et al. (2011)*	Ukkola et al. (2011)*	De Magistris et al. (2015)°	De-Magistris et al. (2015)°	Lis et al. (2015)*	De Magistris et al. (2017)°	Bacigalupe & Plocha. (2015)
Vitality	x																										
	Celiacs														NCGS		Celiacs vs Non Celiacs						Non Celiacs				Par
Celiac vs not																				+	+	+					
Eating problems						+																					
Eating habits			x																						x		
Emotional support																											
Members of association				x										+			x	x									
Mental health						+																					
Self-Restraint						x																					
Shape concerns						+																					
Substance use																											
Weight matters						+																					
Where to buy		x	x																								
Where to eat		x	x								+			+													x

*Descriptive study, no correlation tests were applied between adherence to GFD and factors
#Qualitative studies
°Non-celiacs and not followers of GFD
+Significant correlation with adherence to GFD
[1] Study 1
[2] Study 2
a Studies which have measured the Quality of Life
SDE - Standardized Dietician Evaluation; **BMI** - Body Mass Index; **ETCL** -Enteropathy-associated T-cell lymphoma; **IgA** - Immunoglobulin A; **NCGS** - Non Celiac Gluten Sensitivity

7.2 Interviews of the qualitative study

Intervista Associazione Italiana Celiachia

Presentazione generale (5 min)	1. Qual è il suo ruolo in questa associazione e da quanto tempo lavora qui? 2. Mi può dare qualche notizia su di sé e sulla sua esperienza professionale? 3. Prima di arrivare all'AIC di cosa si occupava?
Descrizione dell'associazione (7 min)	1. Quali sono gli scopi dell'associazione? 2. Approssimativamente quanti soci aderiscono nella vostra associazione? 3. Come l'associazione supporta i soci? 4. Ci può dire quanti sono celiaci e quanti non? 5. Quali sono i partner di AIC? 6. Quali tra questi sono i più importanti e perché?
Soci non celiaci (5 min)	1. Secondo lei perché una persona non celiaca può voler seguire una dieta priva di glutine? 2. Offrite servizi specializzati ai non celiaci? 3. Avete informazione su le caratteristiche dei soci non celiaci?
Prodotti senza glutine (10 min)	1. Quali sono i problemi principali che affrontano i consumatori riguardo alle caratteristiche (sensoriali, non sensoriali e nutritive) dei prodotti senza glutine? 2. Quali sono i prodotti più problematici? 3. Durante questi anni quali sono stati i miglioramenti più importanti riguardo alla dieta senza glutine e i relativi prodotti?
Caratteristiche personali (2min)	Età _____ Titolo di studio _____ Celiaco? Si_____ No_____

Interview consumers

Introduzione (5min)	1. Da quanto tempo seguite la dieta senza glutine e perché è interessata/o al tema del gluten free? 2. Quali sono i prodotti che consuma maggiormente? Trasgredire, a casa seguite tutti la dieta senza gluine? 3. Secondo lei quali possono essere le motivazioni che spingono ad una persona (non celiaca) a comprare prodotti senza glutine?
Descrizione generale dei prodotti (3min)	1. Quali caratteristiche principali deve avere il pane? 2. Quali caratteristiche principali deve avere uno snack?
Confronto genreale fra gluten free-convenzionale (3 min)	1. Cosa vi aspettate ci sia di diverso nel pane senza glutine rispetto ad uno convenzionale? 2. Cosa vi aspettate ci sia di diverso in uno snack senza glutine rispetto ad uno snack normale?
Esperienze all' acquisto (10min)	1. Quando vede il pane senza glutine sugli scaffali dei supermercati cosa le viene in mente? A cosa lo associate? 2. Quando vede gli snack senza glutine sugli scaffali dei supermercati cosa le viene in mente? A cosa li associate? 3. Le sue esperienze positive e negative in merito alle caratteristiche sensoriali del pane senza glutine 4. Mi parli delle sue esperienze positive e negative in merito alle caratteristiche sensoriali dei snack senza glutine 5. Le sue esperienze ed impressioni, positive e negative, in merito alle caratteristiche non sensoriali (prezzo, confezione, informazioni, ecc.) del pane senza glutine? 6. Le sue esperienze e ed impressioni, positive e negative, in merito alle caratteristiche non sensoriali (prezzo, confezione, informazioni, ecc.) degli snack senza glutine?
Caratteristiche personali (2min)	Età __24_____ Titolo di studio _____laurea_____ Familiare celiaco? Si_____ No__x____

Interview retailers

Introduzione (5min)	1. Qual è il suo ruolo e da quanto tempo lavora qui? 2. Di cosa si occupava prima di lavorare in questo negozio? 3. Quali sono i vostri principali fornitori di prodotti senza glutine?
Prodotti senza glutine (15 min)	1. Quali sono le tipologie dei prodotti? 2. Quali sono i prodotti più richiesti? Secondo lei perché? 3. Quali sono i prodotti meno richiesti? Secondo lei perché? 4. Ci sono tipi di prodotti che sarebbero richiesti ma non sono disponibili? 5. Quali sono le caratteristiche per le quali i consumatori si lamentano di più? 6. Quali sono le caratteristiche che piacciono di più? 7. Quali sono le caratteristiche più importanti secondo lei? 8. Cosa si può migliorare in merito a prodotto e comunicazione? 9. Come vedete il futuro del gluten free come segmento di mercato?
Clienti del negozio (6min)	1. Che caratteristiche hanno i vostri consumatori principali? 2. Ci può descrivere il profilo tipico di un non celiaco che segue una dieta senza glutine? 3. Secondo lei cosa spinge i non celiaci a seguire tale dieta?
AIC (2-4 min)	1. Collaborate con AIC? 2. Se si, come?
Caratteristiche personali (2min)	Età _____ Titolo di studio _____ Celiaco? Si_____ No_____

7.3 Questionnaire on adherence to GFD

QUESTIONARIO

Questa indagine fa parte della tesi di dottorato della Dott.ssa Vilma Xhakollari, svolta presso il Dipartimento di Scienze e Tecnologie Agro-alimentari, Alma Mater Studiorum - Università di Bologna, con la supervisione del Prof. Maurizio Canavari.

L'obiettivo è la valutazione dell'accettazione dei prodotti senza glutine da parte dei consumatori. Il questionario richiede circa 15 minuti per essere completato. Il questionario è anonimo, le risposte saranno mantenute strettamente confidenziali e saranno elaborate in forma aggregata per lo scopo specifico di questa ricerca.

Se avesse dei dubbi o avesse bisogno di maggiori informazioni può contattarci via e-mail vilma.xhakollari2@unibo.it, maurizio.canavari@unibo.it o telefonicamente: Tel: +39-0512096103

Informativa ai sensi dell'art. 13 del D.Lgs. 30 giugno 2003, n. 196 "Codice in materia di protezione dei dati personali"

Ai sensi dell'art. 3 del D.Lgs. n. 196/03 "Codice in materia di dati personali", si informa che:

- i dati personali forniti saranno trattati dal Dipartimento di Scienze Agrarie dell'Alma Mater Studiorum - Università di Bologna con sede legale in viale Giuseppe Fanin 50, 40127 Bologna (BO), ed il responsabile del trattamento è il Prof. Maurizio Canavari

- i dati saranno utilizzati per finalità di ricerca e non saranno comunicati ad alcun altro soggetto;

In ogni momento l'interessato potrà esercitare i suoi diritti nei confronti del titolare del trattamento, ai sensi dell'art.7 del D. Lgs.196/2003. Acconsento Non Acconsento

In questa sezione le facciamo alcune domande per capire se rientra nell'obiettivo dell'indagine.

Istruzioni: Completa tutte le domande mettendo il segno "X" nella casella di sua scelta o scrivendo la sua risposta negli spazi appositi

QUAL_02	In quale regione Italiana risiede?	Se lo faremo in tutta Italia

QUAL_03	Sa cos'è il glutine?	○ Si ○ No

QUAL_04	Sa cos'è la celiachia?	○ Si ○ No

QUAL_05	Ha mai sentito parlare dei prodotti senza glutine?	○ Si ○ No

Parte 1: Le domande seguenti hanno lo scopo di individuare la presenza di cibi senza glutine nella sua dieta settimanale. La preghiamo di rispondere a tutte le domande

SEL_ADH_1	Selezioni l'opzione che spiega meglio la presenza del glutine nella sua dieta alimentare settimanale.	○ Mangio solo cibi senza gluti ○ Cerco di evitare il glutine qu ○ Cerco di bilanciare il consum senza glutine ○ Non mi preoccupo della pre

SC_ADH_01	Quando mangia cibi con glutine, lo fa per scelta consapevole?	○ Si (0) ○ No (2)
SC_ADH_02	Se ha risposto Si, Quanto? (seleziona solo una delle opzioni)	○ Porzione normale ○ Spesso, solo un as ○ Raramente, solo u
SC_ADH_02/1	Se ha risposto No, Quando mangia fuori casa, informa la persona che prepara il cibo che lei segue una dieta senza glutine?	○ Si (1) ○ No(0)
SC_ADH_03	Se si, Legge le etichette dei cibi confezionati?	○ Si (1) ○ No (-1)
SC_ADH_04	Se si, Mangia solo prodotti certificati dall'associazione italiana dei celiaci e/o Ministero Italiano della Salute?	○ Si (1) ○ No(0)

GFD_YR	Da quanto tempo segue una dieta in cui evita consapevolmente di mangiare cibo che contiene glutine?	○ Meno di 1 anno ○ 1 anno – 5 anni ○ 6 – 10 anni ○ 11 – 15 anni ○ Più di 15 anni
GFD_ST	Ha deciso di seguire una dieta in cui evita attivamente di consumare cibo con glutine di sua iniziativa, oppure le è stato consigliato da un professionista sanitario?	○ Consigliato da un professi ○ Mia iniziativa ○ Altro (per favore specifica _____ _____ _____

Parte 2. Questa parte comprende domande riguardo la dieta senza glutine. Si prega di indicare il livello di accordo con le seguenti affermazioni. Tenga presente che non esistono risposte giuste o sbagliate. Spesso la prima risposta è la più accurata, consigliamo di non impiegare troppo tempo su di un quesito. Tenga presente che "Totalmente in disaccordo"/ "Totalmente d'accordo" significa “Decisamente No/Si, mentre "Parzialmente in disaccordo"/"Parzialmente d'accordo" vuol dire che non è assolutamente in disaccordo/d'accordo con quanto affermato

QID	Affermazione	Totalmente in disaccordo	Parzialmente in disaccordo	Indeciso
ATT_DIS01	Seguire una dieta priva di glutine fuori casa è difficile	○	○	○
ATT_ADV01	Mantenere una dieta rigorosamente senza glutine riduce al minimo i sintomi della celiachia	○	○	○
ATT_DIS02	Mantenere una dieta rigorosamente priva di glutine incoraggia le persone a seguire una dieta sana (ad es. consumare più prodotti naturali e meno prodotti lavorati/industriali)	○	○	○
ATT_ADV02	La dieta priva di glutine risolve i problemi legati al dolore addominale	○	○	○
ATT_DIS03	Mantenere una dieta rigorosamente priva di glutine riduce al minimo il rischio di sviluppare malattie a lungo termine quali il cancro, l'osteoporosi e l'infertilità	○	○	○
ATT_ADV03	La dieta priva di glutine risolve i problemi legati al gonfiore	○	○	○
ATT_DIS04	La dieta priva di glutine aiuta a perdere peso	○	○	○

ATT_ADV04	La dieta priva di glutine risolve i problemi legati alla diarrea	○	○	○
ATT_DIS05	Le persone che seguono una dieta senza glutine sono più attive fisicamente in confronto a coloro che non la seguono	○	○	○
ATT_ADV05	La dieta priva di glutine risolve i problemi legati all'affaticamento	○	○	○
ATT_DIS06	Credo che una persona dovrebbe seguire la dieta senza glutine solo se consigliato da un professionista sanitario	○	○	○
ATT_ADV06	Una dieta naturalmente senza glutine, cioè composta da cibi che naturalmente non contengono glutine, è più sana in confronto alla dieta senza glutine che comprende prodotti trasformati, cioè pasta, merendine, pizza surgelata, ecc.	○	○	○
INJ_NOR_01	I miei familiari (genitori/fratelli/sorelle/partner/figli) pensano che dovrei seguire una dieta priva di glutine	○	○	○
INJ_NOR_02	I miei amici e colleghi pensano che dovrei seguire una dieta priva di glutine	○	○	○
DES_NOR_01	Nella mia famiglia (genitori/fratelli/sorelle/partner/figli) ci sono persone che seguono una dieta priva di glutine	○	○	○
DES_NOR_02	Nella mia cerchia di amici e/o colleghi ci sono persone che seguono una dieta priva di glutine	○	○	○
FSELF_EFF_01	Sono sicuro/a di saper gestire molto bene la dieta senza glutine	○	○	○
NFSELF_EFF_01	Se fossi un celiaco, sono sicuro/a che saprei gestire molto bene la dieta senza glutine	○	○	○
NF_GFD_INT	E' molto probabile che proverò ad iniziare una dieta senza glutine per mia scelta personale	○	○	○
NF_GFD_CON	Sono sicuro/a che se iniziassi una dieta senza glutine poi non la interromperei	○	○	○

Parte 3: Questa fase riguarda il comportamento, livello di conoscimento e disponibilità a comprare prodotti senza glutine. Si prega di rispondere a tutte le domande. Si prega di indicare il livello di accordo con le seguenti affermazioni. Tenga presente che non esistono risposte giuste o sbagliate. Non impiega troppo tempo per rispondere a ciascuna affermazione, spesso la prima risposta è la più accurata.

QID	Affermazione	Totalmente in disaccordo	Parzialmente in disaccordo	Indeciso
ENV_01	I prodotti senza glutine costano di più in confronto ai prodotti convenzionali	○	○	○
ENV_02	I prodotti senza glutine sono meno gustosi rispetto ai convenzionali	○	○	○
ENV_03	I prodotti senza glutine sono difficili da trovare nei negozi	○	○	○
ENV_04	I prodotti senza glutine sono più poveri in sostanze nutritive rispetto ai prodotti con glutine	○	○	○

Indica secondo lei quale dei seguenti alimenti non contiene, potrebbe contenere o contiene sicuramente glutine

QID	Cibo	Senza glutine	Potenzialmente contenente glutine	Sicuramente contiene glutine
GFKn_01	Miglio in semi	○	○	○
GFKn_02	Pop-corn confezionati	○	○	○
GFKn_03	Farro	○	○	○
GFKn_04	Hamburger	○	○	○
GFKn_05	Carne o pesce impanati	○	○	○
GFKn_06	Formaggi freschi	○	○	○
GFKn_07	Yogurt alla frutta	○	○	○
GFKn_08	Bevande a base di avena	○	○	○
GFKn_09	Funghi freschi, secchi, surgelati tal quali	○	○	○
GFKn_10	Fiocchi di patate	○	○	○
GFKn_11	Frutta candita, caramellata, glassata	○	○	○
GFKn_12	Nettari e succhi di frutta non addizionati di vitamine o altre sostanze	○	○	○
GFKn_13	Bevande a base di latte, soia, riso, mandorle	○	○	○
GFKn_14	Radice di liquirizia grezza	○	○	○
GFKn_15	Torrone, croccante	○	○	○

Il teff è un cereale naturalmente privo di glutine, che può essere usato per realizzare prodotti alimentari senza glutine

GFP_ACCEP	A parità di prezzo, quale delle due opzioni di pasta acquisterebbe al supermercato?	○ Pasta normale di grano (con glutine) ○ Pasta a base di Teff (senza glutine)	0 1

GFP_ACCEP/con glutine	Quale delle seguenti opzioni sceglierebbe?	○ Pasta normale di grano (opzione con glutine) 1.5 euro/kg ○ Pasta a base di Teff (opzione senza glutine) 1.35 Euro/kg	0 1

GFP_ACCEP/con glutine	A parità di prezzo, quale delle due opzioni di pasta acquisterebbe al supermercato?	○ Pasta normale di grano (opzione con glutine) 1.5 euro/kg ○ Pasta a base di Teff (opzione senza glutine) 1.20 Euro/kg

GFP_ACCEP/con glutine	A parità di prezzo, quale delle due opzioni di pasta acquisterebbe al supermercato?	○ Pasta normale di grano (opzione con glutine) 1.5 euro/kg ○ Pasta a base di Teff (opzione senza glutine) 1.05 Euro/kg

GFP_ACCEP/senza glutine	A parità di prezzo, quale delle due opzioni di pasta acquisterebbe al supermercato?	○ Pasta normale di grano (opzione con glutine) 1.35 euro/kg ○ Pasta a base di Teff (opzione senza glutine) 1.5 Euro/kg	0 1

GFP_ACCEP/senza glutine	A parità di prezzo, quale delle due opzioni di pasta acquisterebbe al supermercato?	○ Pasta normale di grano (opzione con glutine) 1.20 euro/kg ○ Pasta a base di Teff (opzione senza glutine) 1.5 Euro/kg

GFP_ACCEP/senza glutine	A parità di prezzo, quale delle due opzioni di pasta acquisterebbe al supermercato?	○ Pasta normale di grano (opzione con glutine) 1.05 euro/kg ○ Pasta a base di Teff (opzione senza glutine) 1.5 Euro/kg

Part 4: Questa fase riguarda il suo stato di salute. E' pregato di rispondere a tutte le seguenti domande.

P_HEL	Di quale dei seguenti sintomi soffre? (Si prega di indicare tutte le voci pertinenti)	○ Carenza di IgA ○ Artrite reumatoide ○ Malattie della tiroide ○ Diabete mellito di tipo ○ Osteoporosi ○ Dermatite ○ Celiachia ○ Sensibilità al glutine ○ Allergie alimentari (Pe ○ _____ ○ _____ ○ _____ ○ Non ho nessuno dei sin ○ Preferisco non dirlo

F_HEL	Qualcuno dei suoi parenti consanguinei soffre dei seguenti sintomi? (Si prega di indicare tutte le voci pertinenti)	○ Celiachia ○ Sensibilità al glutine ○ Allergie alimentari (Pe ○ _____ ○ _____ ○ _____ ○ Nessuno dei miei parer soffre dei sintomi sopra el ○ Preferisco non dirlo

Stato psicologico_ Si prega di leggere ogni frase e poi indicare con quale frequenza la situazione descritta si è verificata negli ultimi sette giorni. Tenga presente che non esistono risposte giuste o sbagliate. Spesso la prima risposta è la più accurata, consigliamo di non impiegare troppo tempo su di un quesito.

QID	Affermazione	Non mi è mai accaduto	Mi è capitato qualche volta	Mi è capitato con una certa
DAD_01	Sentivo la vita priva di significato	○	○	○
DAD_02	Sentivo di valere poco come persona	○	○	○
DAD_03	Non vedevo nulla di buono nel mio futuro	○	○	○
DAA_01	Ho percepito distintamente il battito del mio cuore senza aver fatto uno sforzo fisico (per es. battito cardiaco accelerato o perdita di un battito)	○	○	○
DAA_02	Ho avuto tremori (per es. alle mani)	○	○	○
DAA_03	Ho sentito di essere vicino ad avere un attacco di panico	○	○	○

Part 5: Qualità della vita: Le domande di questa parte riguardano diversi aspetti della sua vita quotidiana. Si prega di rispondere a ciascun elemento anche se non si partecipa attualmente ad un'attività o non si ha una relazione del tipo specificato. Può essere soddisfatto o insoddisfatto di svolgere o non svolgere l'attività o di avere/non avere la relazione. Legga ogni elemento e selezioni quello che meglio descrive quanto è soddisfatto in questo momento. Tenga presente che non esistono risposte giuste o sbagliate. Non impiega troppo tempo per rispondere a ciascuna affermazione, spesso la prima risposta che le viene in mente è la più accurata

QID	Ambito di vita	Estremamente non soddisfatto	Molto non soddisfatto	Non soddisfatto	Mi sento bene	Soddisfatto	Molto soddisfatto	Estremamente soddisfatto	Code
QOL_01	Beni materiali: casa, cibo, accesso alle comodità, sicurezza finanziaria	○	○	○	○	○	○	○	1-7
QOL_02	Salute: essere fisicamente in forma e vigorosi	○	○	○	○	○	○	○	1-7
QOL_03	Rapporti con genitori, fratelli e altri parenti: comunicare, visitare, aiutare	○	○	○	○	○	○	○	1-7
QOL_04	Avere e crescere bambini	○	○	○	○	○	○	○	1-7
QOL_05	Rapporti con coniuge o partner	○	○	○	○	○	○	○	1-7
QOL_06	Rapporto con amici stretti	○	○	○	○	○	○	○	1-7
QOL_07	Aiutare e incoraggiare gli altri, fare volontariato, dare consigli	○	○	○	○	○	○	○	1-7
QOL_08	Partecipare a organizzazioni e affari pubblici	○	○	○	○	○	○	○	1-7
QOL_09	Imparare, frequentare la scuola/lezioni universitarie, migliorare la comprensione, acquisire conoscenze aggiuntive	○	○	○	○	○	○	○	1-7
QOL_10	Capire se stesso - conoscere le proprie risorse e limiti - sapere cosa è la vita	○	○	○	○	○	○	○	1-7
QOL_11	Lavoro –in ufficio o/e da casa	○	○	○	○	○	○	○	1-7
QOL_12	Esprimersi in modo creativo	○	○	○	○	○	○	○	1-7
QOL_13	Socializzare: incontrare altre persone, fare cose interessanti, feste, ecc	○	○	○	○	○	○	○	1-7
QOL_14	Leggere, ascoltare musica o programmi di intrattenimento	○	○	○	○	○	○	○	1-7
QOL_15	Partecipare ad attività ricreative	○	○	○	○	○	○	○	1-7
QOL_16	Indipendenza, autonomia	○	○	○	○	○	○	○	1-7
QOL_17	Disponibilità di assistenza sanitaria	○	○	○	○	○	○	○	1-7

Parte 6: Informazione personale

PSD_01	Sesso	○ Femmina ○ Maschio	1 0
PSD_02	Anno di nascita	|__|__|__|__|	
PSD_03	In quale anno le è stata diagnosticata la celiachia? (solo per i celiaci)	|__|__|__|__|	
PSD_04	Quanti membri ha la sua famiglia (lei incluso/a)?	|__|__|	
PSD_05	Qual è il titolo di studio più alto che ha conseguito fino ad ora?	○ Scuola elementare ○ Scuola media inferiore ○ Diploma scuola superiore ○ Laurea o altro titolo universitario ○ Altro (specificare) |_____| ○ Preferisco non dirlo	1 2 3 4 5 0
PSD_06	Vive con una persona che soffre di celiachia e/o che segue una dieta strettamente senza glutine?	○ Si ○ No ○ Preferisco non dirlo	2 1 0
PSD_07	E' membro dell'Associazione Italiana dei Celiaci?	○ Si ○ No	1 0
PSD_08	Qual è il reddito mensile medio della sua famiglia?	○ < 600 € ○ < 600 € - 1500 € ○ 1.500 - 2.500 € ○ 2.500 –3.500 € ○ 3.500 – 4.500 € ○ > 4.500 € ○ Preferisco non dirlo	1 2 3 4 5 6 0
PSD_08 Optional	Quale di queste risposte descrivere meglio la situazione economica del suo nucleo familiare?	○ Devo fare molta attenzione a ciò che spendo, a volte il mio reddito non basta per acquisti necessari ○ Con un po' di oculatezza posso, ogni tanto, permettermi anche qualche piccolo lusso ○ Non abbiamo problemi economici e quando ho voglia di acquistare qualcosa lo faccio ○ Preferisco non dirlo	1 2 3 0