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Why people follow a gluten-free diet? An application of health behaviour models

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ABSTRACT

Purpose: To understand factors affecting adherence to GFD by celiac and non-celiac people through the application of behavioural theories, Integrative Model (IM) and Multi Theory Model (MTM).
Methods: Analyses were conducted for a sample of 308 subjects, majority females, celiac and non-celiac. Adherence to GFD was measured considering two scales, self-declared adherence and scored adherence, in order to discern possible inconsistencies between what subjects believe and what they really do. Subsequently, adherence to GFD was modelled by considering constructs of MTM and IM. Moreover, the constructs were designed based on literature review. Ordered logit (OL) model was used to test the IM and MTM theoretical models.
Results: The findings show that adherence to GFD is affected mainly by attitudes towards GFD, self-efficacy, injunctive norms, knowledge about GFD and health conditions. Between the two models, IM and MTM, results show that all constructs of IM explain the behaviour. Contrary, for MTM, results indicate only some constructs of the MTM explain adherence to GFD.
Conclusions: Results of this study should be considered for improving the adherence to GFD for celiac people. Furthermore, it is important to consider the non-celiac people's perceptions for GFD and GF products. In other words an accurate information about the diet and products it is relevant for supporting people to make healthier food choices. Finally, as the results show, IM explain adherence to GFD better than MTM.

1. Introduction

A gluten-free diet (GFD) is the avoidance of 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 disorder of the small intestine caused by the ingestion of gluten (A. Lerner, 2010; Trier, 1998). Diagnosis of the CD is crucial since people who are affected experience physical pain like gastrointestinal upset, migraines, weight loss, anaemia, fatigue, but also psychological problems like depression and anxiety (Green & Cellier, 2007; Haines, Anderson, & Gibson, 2008; Scherf, Koehler, & Wieser, 2016). However, CD remains underdiagnosed because the signs and symptoms are similar to other conditions, but with a blood test and a small intestine biopsy, it is possible to determine if a patient is suffering from CD (Green, 2005; Turner, 2018). Moreover, CD is of global concern given its prevalence; worldwide 1.4% have CD based on serological tests, and 0.7% have CD worldwide based on biopsy results (Singh et al., 2018).

Thus, treating the disease using GFD is of high importance, given that it is the only known effective treatment. Research has shown that during the first weeks of GFD's adoption, patients diagnosed with CD reported improvements in the disease's symptoms (Sadeghi et al., 2020). Moreover, the diet prevents and improve symptoms of other diseases associated with CD such as dermatitis (Green & Cellier, 2007), and in many cases, it improves the quality of life (QOL) (Burger et al., 2017; Zingone et al., 2014). Therefore, following GFD is crucial for the well-being of people affected by the CD, so the first main issue this study investigates is how to increase adherence to GFD by those with CD.

However, apart from those with CD, in recent years, people not suffering from CD are also embracing the GFD. For instance, according to the Nielsen report on healthy eating, 23% of the survey participants avoided gluten (Nielsen, 2015). Moreover, in Italy, approximately 6 million people follow a GFD voluntarily (Associazione Italiana Celiachia, 2017). This situation raises the question: Why do people without CD follow a diet specifically required for people suffering from CD?

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Work suggests that the followers without CD of the GFD diet can be divided into two groups, those who follow the diet due to health reasons and those who follow the diet for other reasons. Regarding the first group, people suffering from wheat intolerance and non-celiac gluten sensitivity (NCGS) are recommended to reduce the intake of gluten in their diet even though, unlike CD, they are not considered affected by an autoimmune disease (Catassi et al., 2017; Newberry, McKnight, Sarav, & Pickett-Blakely, 2017). Furthermore, GFD has been recognised as a treatment option for other conditions, like dermatitis herpetiformis, anaemia, irritable bowel syndrome, rheumatoid arthritis, diabetes mellitus, HIV-associated enteropathy, autism and other neurologic disorders (Bürk et al., 2009; El-Chammas & Danner, 2011; Srihari; Mahadev et al., 2013; Samasca et al., 2017).

Regarding people who follow the diet for non-health-related reasons, the authors categorised them into two subgroups: firstly, family members of people with CD follow a GFD to avoid food contamination at home. Since the predisposition to the disease is considered inherited, the GFD might prevent its appearance to other members (Bogue & Sorenson, 2008). Secondly, other people who do not have any specific symptoms have recently been following the diet, mainly influenced by celebrities not suffering from CD who state that GFD can help with weight loss, and boosts energy (Ranker, 2015). These beliefs have been put into question through a study that found that GFD helps manage weight for people without CD (Kim et al., 2017). However, this study has some limitation in terms of its retrospective nature and its ability to make only potential associations without establishing causality. Moreover, in the study, just 1.3% of people without CD reported following a GFD.

Hence, the second topic the present study focuses on is to discern the factors that drive people without CD to follow the diet and ways to support them in making healthy food choices. To date, there is limited research directed towards understanding why people without CD follow the GFD diet. This aspect is of high importance since, so far, research has failed to show that GFD is a better diet option for the general population without CD (Gaesser & Angadi, 2012; B. A.; Lerner, Green, & Lebwohl, 2019; Marcason, 2011; Niland & Cash, 2018). In line with this, D. Lis, Stellingwerff, Kitic, Ahuja, and Fell (2015) did not find any effect of the GFD on athletes' overall performance not suffering from CD.

Hence, while following GFD is strongly related to the well-being of people suffering from CD, the reasons why people without CD follow a GFD remain unclear. Why are people ready to pay higher prices and engage in a diet which has not been scientifically proven to be healthier than other options? How is it possible to improve adherence to GFD by people with CD and others who follow the diet for health reasons?

This study uses health behaviour models, the Integrative Model (IM) and the Multi Theory Model (MTM), for distinguishing factors that affect adherence to GFD among adults with and without CD and to respond to the aforementioned empirical questions. This research is relevant for the field since, to date, a limited number of studies have applied behavioural models aiming to understand and improve adherence to GFD by people with CD, and no previous studies have considered people without CD. So far, Protection Motivation Theory (PMT) and Theory of Planned Behaviour (TPB) have been used to understand adherence to GFD. The PMT identifies the way people engage in a given behaviour due to fear appeal, which, according to the theory, is composed by three components (a) the magnitude of noxiousness of a depicted event; (b) the probability of that event's occurrence; and (c) the efficacy of a protective response (Rogers, 1975). The TPB, on the other hand, is based on the Theory of Reasoned Action (TRA) and states that individuals, based on the given information, make rational and target-directed decisions (Ajzen, 1991).

As previously mentioned, both theories have been considered to identify factors affecting adherence to GFD from part of people suffering from CD. Dowd, Jung, Chen, and Beauchamp (2015) applied the PMT in their study and found that self-regulatory efficacy indirectly predicted purposeful gluten consumption instances through intentions and directly predicted accidental gluten consumption. However, the authors of this study did not consider social norms. Moreover, Sainsbury and Mullan (2011); Sainsbury, Mullan, & Sharpe (2013) and (2015) have applied the TPB to understand adherence to GFD by people with CD. They found that TPB is good at predicting adherence to GFD.

Nevertheless, the theories mentioned above present some limitations. Firstly, PMT does not consider other environmental factors and cognitive variables that might influence the extent to which an individual will (or not) engage a particular behaviour (Rogers, 1975). Secondly, Dowd et al. (2015) did not consider social norms in their model, but, in recent years, studies use social norms to change people's health-related behaviour (Mollen, Rimal, & Lapinski, 2010). In addition to this, scholars are suggesting that there are two groups of social norms: beliefs about what others do (*descriptive norms*) and beliefs about what others think an individual should do (*injunctive norms*) (Cialdini et al., 2006; Cialdini, Reno, & Kallgren, 1990; Cislaghi & Heise, 2019); these need to be considered as having potentially different bearings on behaviour. Thirdly, theories based on TRA and TPB tend to neglect aspects of human behaviour such as compulsive behaviour or emotional behaviour (Armitage, Conner, & Norman, 1999).

However, the IM, based on the TRA and developed by Fishbein in 2008, has overcome the limitations listed above. Nevertheless, according to Fishbein (2008), TRA-based theories are inclusive, given that they take into account background factors that will have a causal influence on behaviours. Fig. 1 shows a schematic representation of IM and the relation of the factors that affect the behaviour. It explains the way an individual follows a particular behaviour based on several critical factors.

IM states that an intention to execute a particular behaviour does not always predict the behaviour itself because people do not act according to their intention (e.g., intention action gaps). As Fig. 1 shows, it might happen that even though an individual has a positive intention towards a given behaviour, he/she does not perform the behaviour because he/she does not have the necessary skills and abilities or internal/external barriers (environmental factors) prevent him/her from doing it (Fishbein, 2008). Moreover, in line with scholars' recommendations, IM considers subjective norms as a function of descriptive and injunctive norms.

Another more recent theory is the multi-theory model (MTM) of health behaviour change (Manoj Sharma, 2015). The model is also based on the TRA and puts together empirically tested constructs from previous theories. However, MTM advantage is that it overcomes some limitations of the previous theories. Firstly, it considers both one-shot as well as long–term behavioural changes; secondly, it is applicable at individual, group and community levels; thirdly, it is applicable in different cultures, which seems to be one of the biggest disadvantages of the previous models since they were applied mainly with western countries' people (Manoj Sharma, 2015). The model considers behaviour as the outcome of two phases: first initiating the behaviour change (Fig. 2) and second, the behavioural change's sustainability (Fig. 3).

As previously mentioned, understanding behaviour associated with GFD is important for people with CD since GFD is the only treatment for

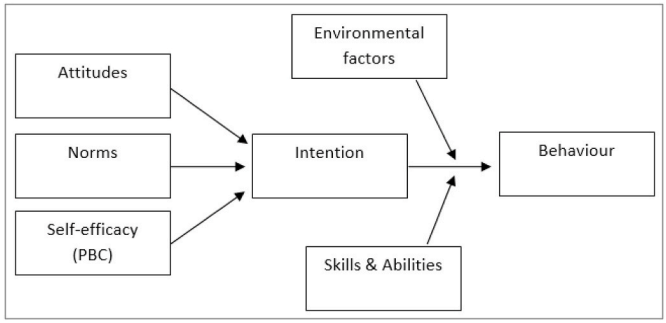

Fig. 1. Integrative model (Fishbein, 2008).

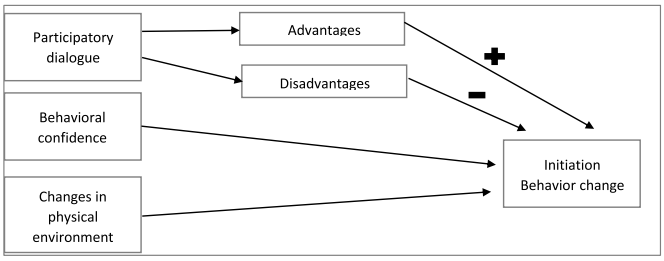

Fig. 2. Initiation model, MTM (Sharma, 2015).

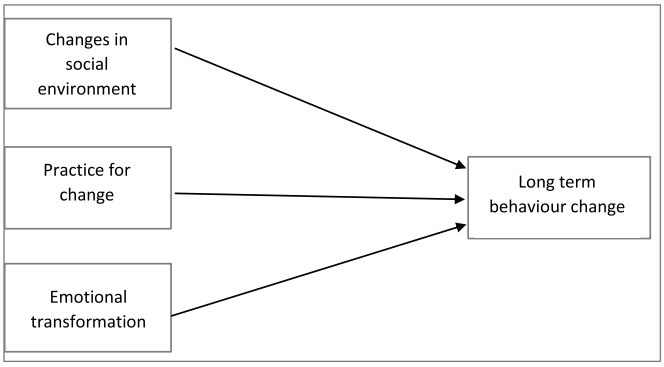

Fig. 3. Continuation model, MTM (Sharma, 2015).

the disease. In contrast, no research has found that GFD is a healthier option for consumers without CD who have no health-related reasons, yet they follow the diet, so it is important to examine the motivation for those that still adhere to it.

To this end, this study's main objective is to understand, by using health behaviour models such as IM and MTM, the factors that are most influential in motivating adherence to the GFD for both, people with and without CD.

While IM has been applied in a variety of domains, such as sexual dysfunctional behaviour (Buhi et al., 2014) and sleep dysfunctions (Robbins & Niederdeppe, 2015; Tagler, Stanko, & Forbey, 2017), with one exception (e.g. Collado-Rivera, Branscum, Larson, & Gao, 2018), it has not been implemented in the food consumption domain. According to Collado-Rivera et al. (2018), IM is a useful model for explaining sugary drink consumption among overweight and obese adults, and so it is considered worth extended in the present context of GFD.

Similarly, MTM has also been implemented in a variety of domains such as to understand physical activity (Bridges & Sharma, 2017; Manoj Sharma et al., 2016), and smoking (M Sharma, Khubchandan, & Nahar, 2017; Manoj Sharma, 2017), but again, with few exceptions, it has not been frequently applied in the food consumption domain. Two studies reported that they could use MTM to successfully predict and explain health behaviours related to food (Manoj Sharma, Priest Catalano, et al., 2017; 2016). One study aimed at understanding how the model could predict the consumption of small portions of food (Manoj Sharma et al., 2016) and the other one measured the behaviour change for the consumption of water instead of sweetened drinks. Given the purported success, for the same reasons as with IM, we consider it worthwhile testing the generalisability of MTM by examining its applicability in the domain of GFD.

2. Methods

2.1. Data collection

The data were collected in Italy, from May to June 2018, recruiting participants with and without CD, who were either GFD followers or non-followers. The survey was designed and administered using the online survey service Qualtrics. Participants were recruited through social media (Facebook groups dedicated to CD and GF products), events dedicated to CD, and visits to supermarkets and specialised stores where leaflets were given to participants with the survey's link. Since some of the questions covered aspects of psychological and health status, and quality of life (QOL), participants self-administered the questionnaire to reduce the possible biases generated by face-to-face interviewing.

The questionnaire lasted 15 min, and the participation was voluntary. Participants were informed from the beginning that they were not going to receive incentives for participating in the study.

2.2. Model constructs and hypothesis generation

Small modifications to the original versions of the IM and MTM were deemed necessary for both models to adapt them to the study's objectives and study context.

Firstly, the study focused on both participants who belonged to the group with CD, and participants without CD (who followed the GFD, or not). Given this complex combination of participants, the authors, considering the core of IM and MTM, made some adjustments in applying the models to the participants. Thus, IM was applied to all the study participants, with and without CD, following or not the GFD. Secondly, MTM's initiation behaviour change model describes the process of moving from one behaviour (not following the GFD) to another (starting the GFD). Thus, the authors considered applying this model only to people who are not following the GFD.

On the other hand, MTM's sustainability of behavioural change model describes the process of performing the behaviour over a period of time (continue to follow GFD). Therefore, this model was applied to participants who already follow the diet. According to Sharma (2015), this differentiation is important because the constructs that affect change initiation are different from the constructs that influence sustained behavioural change. Moreover, since the initiation model does not measure the actual behaviour but the intention to engage in the behaviour, the dependent variable for this model was the intention to start following the GFD and the actual behaviour, adherence to GFD that served as the dependent variable for the continuation model.

Regarding the constructs for the theoretical models (IM and MTM), we relied on the results from reviews on the adherence to GFD (Hall, Rubin, & Charnock, 2009a; Sainsbury & Marques, 2018; Xhakollari and Canavari, 2019). Hall et al. (2009a) 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. (2009a) did not consider aspects of GF products, and their search was limited only to people with CD. More recently, another systematic review aimed at understanding the relationship between depressive symptoms and adherence to GFD (Sainsbury & Marques, 2018). They found that higher levels of depression are associated with lower adherence to GFD, but the authors suggest carefully considering these findings because the number of studies meeting the inclusion criteria is limited (Sainsbury & Marques, 2018).

Nevertheless, both these studies focus on people with CD and have considered only a few factors affecting adherence to GFD. In addition to this, Xhakollari et al. (2019) conducted a review considering people with CD and other people who for reasons other than CD follow the GFD. Results of this review show that adherence to GFD is affected by eight factors (Fig. 4).

Thus far, we have explained the necessary changes of IM and MTM and possible factors affecting GFD. The following paragraphs will explain the hypotheses that this research is putting forward and introduce, in a schematic way, the models applied to this study.

Going back to IM, attitudes are considered as important for explaining the behaviour. Therefore, the study proposes the following Hypothesis:

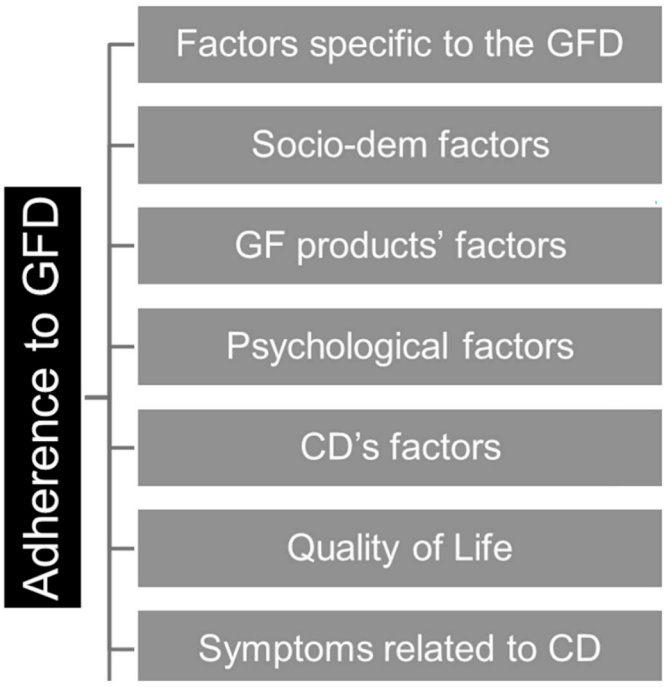

Fig. 4. Factors affecting adherence to GFD (Xhakollari, Canavari, & Osman, 2019).

Hypothesis 1. Attitudes towards the GFD affect adherence to GFD.

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

Hypothesis 2a. Strong injunctive norms improve adherence to GFD

Hypothesis 2b. Strong descriptive norms improve adherence to GFD.

However, in MTM, this construct does not appear. The model suggests that others' support is more important for performing and maintaining a behaviour (following GFD) than what others do or believe (Manoj Sharma, 2015). According to Xhakollari et al. (2019), changes in the social environment are related to constructs of QOL, which include the degree of satisfaction with the support from family members and friends, and the support given by medical services. Thus, the Hypothesis, in this case, is:

Hypothesis 3. Participants receiving high support by others have higher adherence to GFD.

Self-efficacy is one's belief to succeed in a given situation or achieve a specific behaviour (Bandura, 1982). Both IM and MTM, consider this factor as very important for performing and maintaining the behaviour (adherence to GFD). Thus the Hypothesis is:

Hypothesis 4. Participants with high self-efficacy have higher adherence to GFD.

In their articles about the theoretical explanation of IM and MTM, Fishbein (2008) and Sharma (2015) do not provide a detailed explanation of the environmental factors affecting the behaviour. After careful consideration of the reviews' results, the authors of the present study have acknowledged the possibility that attitudes towards GF products, QOL, depression and anxiety, knowledge and health conditions affect adherence to GFD and the continuation to follow the diet. Thus the hypotheses are:

Hypothesis 5a. Perceptions about GF products affect adherence to GFD.

Hypothesis 5b. Participants with high levels of QOL have a higher level of adherence to GFD.

Hypothesis 5c. People with high levels of depression and anxiety do not follow a strict GFD.

Hypothesis 5d. Participants with a high level of knowledge of GF products have higher adherence to GFD.

Hypothesis 5e. The presence of diseases related to CD affect adherence to GFD.

Fig. 5 and Fig. 6 present, respectively, the IM and MTM continuation model applied in our study.

Regarding the "initiation model", changes in the physical environment have been considered important when predicting the behaviour. In this case, after considering results from Xhakollari et al. (2019), attitudes towards GF products have been seen as elements of the changes in the physical environment construct of the theoretical model. 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, attitudes towards GF products will increase the possibility to follow GFD.

Fig. 7 shows the initiation model applied to this study.

2.3. Study design[1]

The survey was designed by considering mainly constructs of the IM and MTM. At first, participants were asked to consent on their data usage and were assured that all the information they would provide saved their anonymity. The Bioethics Committee of the University of Bologna approved the research design and the questionnaire on the 9th of May 2018 (protocol number 68236).

At first, screening questions were included, and participants were asked to answer with "Yes" or "No" if they knew 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 answered "No" to one of these questions, they could not continue with the questionnaire.

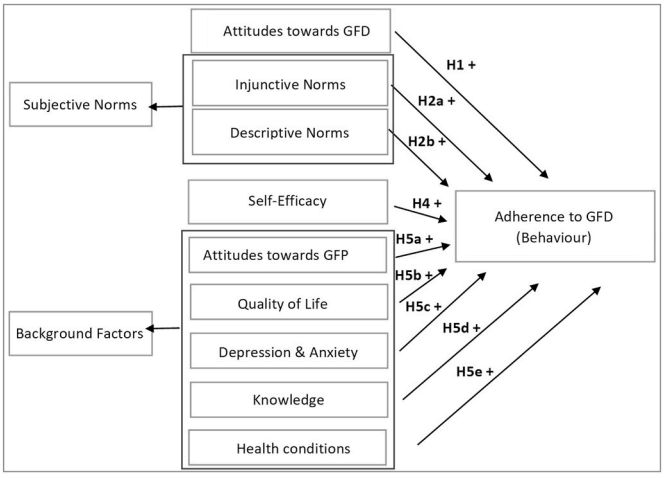

Fig. 5. Adherence towards GFD explained by the Integrative Model.

[1] Please refer to appendix 1 for the full questionnaire of the study.

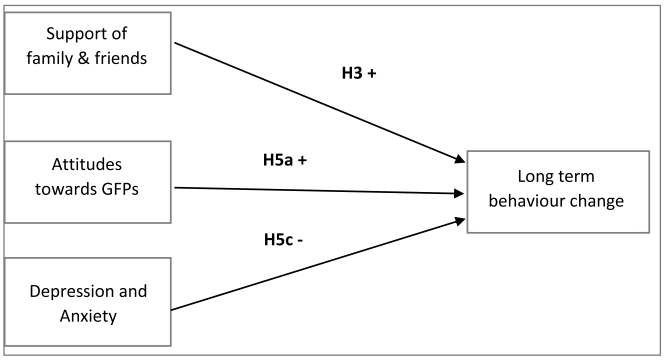

Fig. 6. Continuation of the GFD explained by the Multi Theory Model.

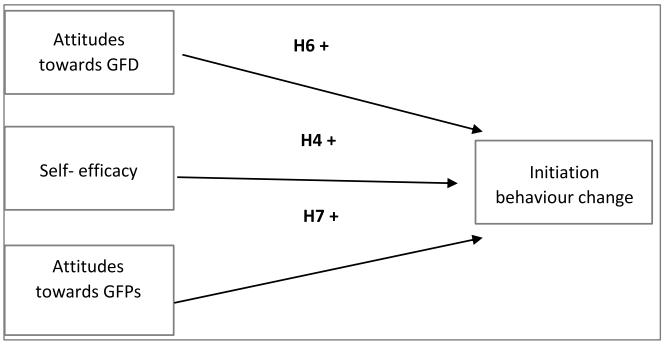

Fig. 7. Intention to initiate the GFD explained by the Multi Theory Model.

The second part of the survey consisted of questions related to the GFD. Firstly, participants were asked to self-declare adherence to GFD. Afterwards, participants that declared to follow GFD were asked a set of questions, developed by Biagi et al. (2009), to evaluate the level of adherence to the GFD, which we will call scored adherence to GFD. This question was not applied to individuals who responded "*I don't mind the presence of gluten in the food I consume*" to the scale developed by the authors. According to Biagi et al. (2009), from a clinical point of view, the scored adherence can be divided into three groups: 0–1 point, participants do not follow a strict GFD; 2 points, participants are following GFD, but with mistakes; and 3–4 points, participants are following a strict GFD.

The third part consisted of questions regarding attitudes towards GFD. Participants were asked to evaluate on a Likert-like scale ranging from 1 (Strongly disagree) to 5 (Strongly agree) a set of statements retrieved from existing literature (De-Magistris, Xhakollari, & De Los Rios, 2015; de Magistris, Xhakollari, & Munoz, 2015; Edwards George et al., 2009; D. M. Lis, Stellingwerff, Shing, Ahuja, & Fell, 2015; Sainsbury & Mullan, 2011; Shah et al., 2014; Ukkola et al., 2012a; Villafuerte-Galvez et al., 2015; Vilma Xhakollari & Canavari, 2019).

The same Likert scale was applied for measuring subjective norms, self-efficacy and intention to start a GFD. Subjective norms were measured by distinguishing between injunctive norms and descriptive norms. Regarding self-efficacy, the authors measured it by distinguishing between followers and non-followers of the diet.

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. This question aimed to split the sample between people with and without CD and better understand the participants' background.

The fifth part consisted of questions related to GF products. Firstly, participants were asked to evaluate the level of agreement with four statements regarding GF products, using a Likert-like scale from 1 (Strongly disagree) to 5 (Strongly agree). The second question of this part was about the knowledge of GF products. Participants were asked to evaluate from a given list of products if they were 1) GF, 2) potentially containing gluten, and 3) containing gluten. The scale was developed considering Silvester, Weiten, Graff, Walker, and Duerksen (2016), but, to adjust products to the Italian market, some items were chosen from the Italian Celiac Association web site (Associazione Italiana Celiachia, 2001).

The sixth part of the questionnaire evaluated the level of Depression and Anxiety. The scale was adopted from Lovibond and Lovibond (1995). However, considering the questionnaire's length, we reduced the items to six, selecting those items with the highest factor loadings. Cronbach's alpha coefficient is considered strong (raw alpha = 0.8 and standard alpha = 0.8).

The seventh part of the survey focuses on quality of life, which used the scale developed by Burckhardt and Anderson (2003) since it is a consolidated scale for measuring QOL and has been applied to other studies on GFD. Participants were asked to estimate how they felt about different aspects of their life on a nine-level scale. However, an item on the medical support was added since many studies have shown that it affects adherence to GFD (Ferster, Obuchowicz, Jarecka, Pietrzak, & Karczewska, 2015; Muhammad, Reeves, Ishaq, Mayberry, & Jeanes, 2017; J. A.; Silvester et al., 2016). Also in this case, the Cronbach's alpha coefficient is considered strong (raw alpha = 0.89 and standard alpha = 0.89).

Finally, to evaluate the participants' profile, the last part of the questionnaire consisted of questions on the sample's socio-demographic characteristics.

2.4. Data analysis

Data were analysed using R Core Team (2019) 4.0.3. Firstly, descriptive statistics allowed to understand the general profile of the participants. Secondly, correlation tests were applied to understand if the model's constructs were associated with each other. An Ordered logit (OL) model was used to test the IM and MTM theoretical models using the survey data. The OL statistical model was chosen because of the type of dependent variable (adherence to GFD), measured using an ordinal scale, and the assumed relationship between the dependent and independent variables.

3. Results

Most of the participants were recruited through social media (54.5%) and activities and face to face (44.8%). Selected demographic characteristics are shown in Table 1. The majority of participants were female (80.19%), and the average age of respondents was 39 years old. This sample profile is in line with the fact that CD mostly affects females (Singh et al., 2018) and that females are more concerned about food (Charlton et al., 2014; Dean, Lähteenmäki, & Shepherd, 2011) and their body shape (Pudney, Himmelstein, Puhl, & Foster, 2020; Satherley, Howard, & Higgs, 2016). Most respondents have a University Degree (49.03%) or a high school diploma (35.39%), and none had elementary education level.

As described in the methodology section, adherence was measured by considering the scale used by Biagi et al. (2009) and another scale designed by the authors, to evaluate if there is any consistency between what participants declared (authors' scale) and their scored adherence (Biagi's scale).

Table 2 shows that 13.31% of the participants who declared that they followed a strict GFD scored 0–1 points, suggesting that what they self-declared was not consistent with what they actually do. This finding is very important, especially for individuals who follow GFD because of health problems.

Considering both scales' results, a new variable was created that represents GFD adherence from all participants. The new adherence variable classifies the respondent's adherence to GFD using three levels, where 1 = do not follow a GFD (includes all those who responded "I

Table 1
Socio-demographic characteristics of the participants.

Characteristics	Share of Total (%)
Gender	
Female	80.19%
Male	19.81%
Age (Median)	*39 years old*
18–30	26.62%
31–50	52.27%
51–60	16.23%
Older than 60	4.88%
Education level (Modal categ.)	*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%
Background with CD (Modal categ.)	*People without CD*
People with CD	35.01%
Having a family member with CD	11.69%
People without CD	46.75%
Self-declared adherence (Modal categ.)	*I eat only GF products*
I don't mind the presence of gluten	35.4%
I try to balance	11.04%
I try to avoid gluten	8.44%
I eat only GF products	45.13%
Scored adherence (Median)	*0-1 points*
0–1 points	67.53%
2 points	0.97%
3–4 points	31.49%

Table 2
Cross data on self-declared and scored adherence to GFD.

Scored adherence				
		0–1	2	3–4
Declared adherence	I don't mind the presence of gluten	35.39%	0%	0%
	I try to balance	10.39%	0.65%	0%
	I try to avoid gluten	8.44%	0%	0%
	I eat only GF products	13.31%	0.32%	31.49%

don't mind the presence of gluten"), 3 = follow a strict GFD (includes and those who responded "I eat only GF products" and scored 3–4), and 2 = follow the GFD with mistakes (includes all those who are in between) (Table 3).

3.1. Results of IM and MTM explaining adherence to GFD

Results of IM are shown in Table 4 and support for the hypotheses examined in this study are presented in Fig. 8. The findings show that the factors affecting adherence to GFD are related to attitudes towards GFD, injunctive norms, self-efficacy and background factors, such as knowledge and health conditions.

Concerning the initiation of the GFD, we applied it only to non-followers of the diet. In this case, the dependent variable was not the adherence to GFD, but participants' intentions to start following the GFD, measured on a 5 point scale. Results are shown in Table 5 and Fig. 9. The findings reveal that people who think that following a GFD

Table 3
Participants' adherence to GFD.

	Adherence to GFD		
	Do not follow GFD	Follow GFD with mistakes	Follow strict GFD
Percentage of participants	35.39%	33.12%	31.49%

Table 4
Results on IM.

		Dependent variable:
		Adherence to GFD
Attitudes Towards GFD	A person should follow GFD only if prescribed by a health professional	−0.368***
Injunctive norms	My family and friends think I should follow GFD	0.662***
Self -efficacy	I manage/I would manage very good the GFD	0.319***
Background factors	Knowledge	0.084*
	Not suffering from celiac disease	−3.818***
	Diseases related to gastrointestinal disorders	1.894***
	Observations	308

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

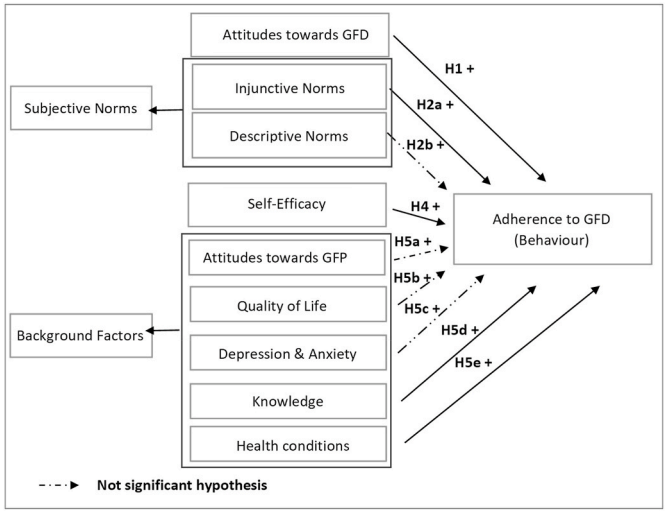

Fig. 8. Results of IM about adherence to GFD.

Table 5
Results on MTM (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.

helps to maintain a healthier diet and helps one to be more physically active more likely intend to start following a GFD. Thus, considering the hypotheses for the initiation model and these results, we confirm only Hypothesis 6. Hence, beliefs play an important role in people without CD who are considering following a GFD.

Regarding the continuation model, we applied it only to the followers of GFD. However, our analysis found that none of the factors explains the continuation of the GFD. Thus, we cannot confirm any of the hypotheses we put forward in this study regarding the continuation model (Fig 10).

4. Discussion and conclusions

Recently, a high number of people are following the GFD. Apart from

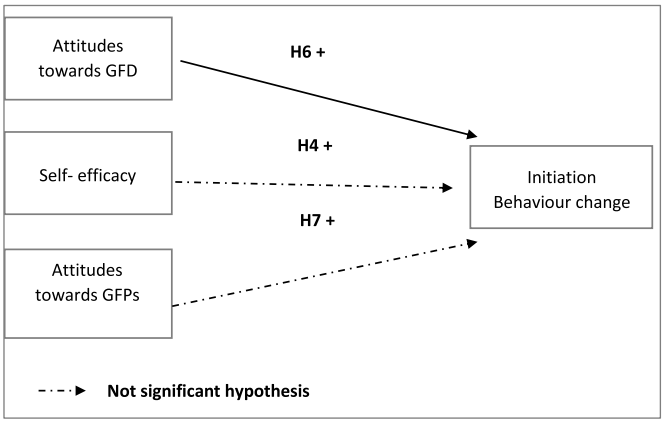

Fig. 9. Results of MTM (initiation model) on the intention to start following GFD.

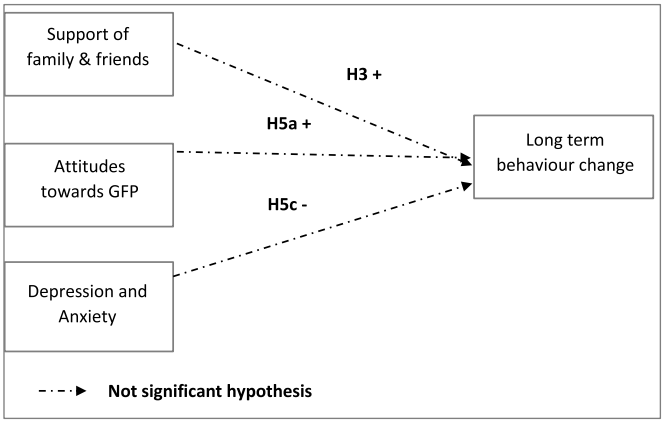

Fig. 10. Result of MTM (continuation model) on adherence to GFD.

people with CD, people without CD are also embracing the GFD. The reasons for this behaviour appear to be variable, but most of them follow the GFD because it is prescribed by a health professional since GFD, according to some research, might improve symptoms of other diseases. Also, family members of people with CD tend to follow the GFD at home to avoid possible food contamination of their relatives with CD. Furthermore, other people without CD are voluntarily following the diet because they believe it is healthier and helps them stay in shape. However, to date, research has not verified these beliefs.

On the contrary, it has been shown that GF products suffer from low nutritional properties (Demirkesen & Ozkaya, 2020; Guennouni, El Khoudri, Bourrhouat, & Hilali, 2020) especially in terms of proteins (bread and pasta) (Missbach et al., 2015; Wu et al., 2015) and content of fat and sodium, minerals and vitamins (Pellegrini & Agostoni, 2015). Hence, this research aimed to shed light on some of the main factors affecting adherence to GFD for people with and without CD by considering health behaviour models. The IM and MTM models were taken into account since IM includes all the previous theories on health behaviour, and MTM is one of the most recent theories in the field. Both models have overcome some limitations of previous theories on health behaviour.

The results from the present study can be summarised as follows. Overall the findings show that adherence to GFD is affected by beliefs and attitudes towards the diet (supporting Hypothesis 1). It was found that the belief that GFD should only be started if a health professional prescribes it explain adherence to GFD. These results are in line with other studies that have found that perceptions on GFD are fundamental when embracing the GFD (Leffler et al., 2008, 2009; Sainsbury & Mullan, 2011; Villafuerte-Galvez et al., 2015).

Furthermore, this study found that self-efficacy (Hypothesis 4) and injunctive norms (hypothesis 2a) that is, what other family members and close friends think a person should do, are also essential factors that should be taken into account when trying to understand the behaviour towards GFD. Previous studies have found similar results. According to Ford, Howard, and Oyebode (2012), perceived self-efficacy should be considered for psychological interventions for individuals with CD. Nevertheless, for individuals who do not follow GFD, our research did not find that self-efficacy is an important factor for initiating the diet.

Finally, background factors, such as knowledge (Hypothesis 5d) and health conditions (5e), explain adherence to GFD. Other studies have also found that people with a high level of knowledge regarding GFD and GF products have higher possibilities to follow a strict GFD (Leffler et al., 2008; Muhammad et al., 2017; Rajpoot et al., 2015; Rocha, Gandolfi, & Dos Santos, 2016; Jocelyn A.; Silvester et al., 2016; Villafuerte-Galvez et al., 2015).

Nevertheless, some factors that have been considered important in explaining adherence towards GFD were not retained as relevant and did not hold for this study. Our study does not confirm that descriptive norms affect adherence to GFD (Hypothesis 2b). To the best of our knowledge, no previous study has investigated this relation. Thus, future research should consider this aspect carefully. Also, previous research on GFD has found that QOL (hypothesis 5b) and depression and anxiety levels (hypothesis 5c) are important factors in explaining the behaviour towards GFD (Barratt, Leeds, & Sanders, 2011; Borghini et al., 2016; Francesc Casellas et al., 2008; Francisco Casellas et al., 2015; CASTILHOS et al., 2015; SriHari Mahadev, Gardner, Lewis, Lebwohl, & Green, 2015; Paarlahti et al., 2013; Peters, Biesiekierski, Yelland, Muir, & Gibson, 2014; Rose & Howard, 2014; Sainsbury & Mullan, 2011; Sainsbury, Mullan, & Sharpe, 2015a, 2013b; Ukkola et al., 2011, 2012b). However, in this study, we did not find the same results. It is important to stress that, to date, studies have measured factors affecting adherence to GFD by separately considering people with and without CD who follow GFD. Hence, future research must examine both groups simultaneously to prove this study's results or focus on non-celiac people following a GFD voluntarily.

Another key point of this study was to find out how health behaviour models, IM and MTM, explaining adherence to GFD. We found that all IM constructs explain well adherence to GFD, which, according to IM, is affected by attitudes towards GFD, injunctive norms, self-efficacy and background factors, such as knowledge and health status. Regarding the MTM, instead, the constructs of the continuation models failed to explain adherence to GFD. Still, 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, Priest Catalano, et al., 2017; Manoj Sharma, 2017; Manoj Sharma, Priest Catalano, 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, further research is important to understand if the results of this study on MTM also apply in other cases with real behaviour and not only the intention to engage in the behaviour.

In conclusion, people follow GFD mainly because of their health conditions: suffering from CD and other diet-related symptoms. However, people follow GFD also because they follow some beliefs about the unproven benefits of the diet, even though this leads to less strict adherence. Hence, it is crucial to provide consumers with clear information about the true effects of the diet, and it is necessary that before engaging in a behaviour that affects health, to get informed by health professionals. Non-celiac people following GFD was also raised as a concern by some celiac people, who declare that due to this phenomenon, their diet and the related health effects may not be taken seriously, especially by catering services (V. Xhakollari & M. Canavari, 2019).

By considering these results, policy-makers should be concerned

about non-celiac people who baselessly follow GFD, for which research has not found confirmed benefits for healthy people. It is important to provide them with the necessary information about the diet's side effects and its relevance for the people who follow it due to specific health conditions. Hence, specific information policies addressed to non-celiac people and catering services must be undertaken with institutions that protect and support the celiac population and other people who follow GFD for health reasons.

5. Limitations

Despite its contribution, this research presents limitations in terms of 1) sample representativeness and 2) measurement of adherence to GFD and DASS.

Most of the participants in the study are females. Nevertheless, according to many studies, females are mostly affected by CD (Catassi, Gatti, & Fasano, 2014; Singh et al., 2018) and concerned about body shape and diets (Del Moral-Agúndez & Carrillo-Durán, 2020; Horndasch et al., 2015). Furthermore, the authors could not report a response rate since they do not have an instrument for measuring the number of people who saw the post on social media and the number of people who received the leaflets. However, in total, 535 people started the questionnaire, and 308 completed it.

The study measured the reported adherence to GFD similarly to other studies by considering two measurements: by asking participants directly and indirectly by scoring their adherence to GFD through a scale used in other studies in Italy. Some studies, though, have measured adherence through clinical analysis, to mention Barratt, Leeds, and Sanders (2013) and Tang et al. (2018), and this may be a viable alternative for future research conducted by researchers with the appropriate background. Finally, the DASS applied in this study is a reduction version of the original one. However, the alpha coefficients are considered as good. Thus, this limitation should be considered for the interpretation of the results.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.appet.2021.105136.

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