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Health engagement, mood, and food choices

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1. Introduction

1.1 A consumer psychology perspective on food choices

This work stems from a -somehow trivial- consideration: food and nutrition are a fundamental aspect of human well-being and health. Indeed, literature shows, a poor diet is a major risk factor in the development of several diseases including -but not limited to- coronary heart disease, strokes, and diabetes (Willett & Stampfer, 2013), as well as gastro-intestinal diseases such as Inflammatory Bowel Diseases (Hou et al., 2014; Mehrabani et al., 2017). A balanced, healthy diet comes with a series of benefits, which go beyond prevention of diseases: a longer life expectancy, a higher productivity, and an overall improved quality of life, while also reducing costs for healthcare and the impact on the public health systems (Anekwe & Rahkovsky, 2013).

Choosing to eat healthier foods seems like a no-brainer, right?

When it comes to choosing, however, people are hardly serial, logical machines. We make poor choices unfortunately often: we leave the umbrella home because "today it's never going to rain!", we gamble (i.e.: lose money) at the casino, we waste money to play -actually, to lose- the lottery, and so on; decision making is such a complex task that even trained physicians have -under certain circumstances- difficulty in making correct probability assessments (Crupi et al., 2018)!

This is because, generally, when it comes to choosing we don't rationally weight benefits over costs, nor we are generally capable of making an exact (or close to exact) estimation of the probabilities involved, which lead to wrong choices.

Instead, we tend to rely on a series of non-logical aspects when making decisions. Heuristics are a famous example of this (Kahneman, 2011): although necessary for our daily functioning, given their nature heuristics are not completely reliable mechanisms, especially when it comes down to complex decision-making or risk assessment, as they are responsible for most of the known cognitive biases, which in turn impact our ability to make sound decisions. For instance, regarding prevention, literature seem to suggest a relationship between cognitive biases and vaccine hesitancy during the COVID-19 pandemic (Casigliani et al., 2022). In addition to heuristics, there's several other factors that don't account for our rationality that, ultimately, play a role in how we make decisions and choose -for instance- what to eat.

Let's take a look at decision making from the consumer-psychology perspective, also looking at its history: in contrast with one of the first models that tried to describe the consumer decision-making process from an economic perspective (Engel et al., 1968), which sought the consumer journey as a linear pathway leading from recognizing a need to the purchase of the best (from a cost/benefit perspective) item that satisfies the need, consumer psychology have demonstrated that several irrational factors (i.e.: not based on logical and sequential decision-making processes) play an important role in defining what a consumer desires and, ultimately, decides to buy and consume.

Since Maslow published his classic paper "A theory of human motivation" (1943), we know that there is a hierarchy of needs (from basic to more complex ones) that drive human behavior and choices through motivations. Motivation is a state of tension that rises when the desired state of the person is different and incongruent

with the current state: this tension creates a *drive*, an experience of the human being that leads him/her towards the fulfillment of his/her own goals, such as reducing hunger (Lozza & Graffigna, 2022; Niosi, 2018). However, as for most consumer behaviors, food choices are not always driven by explicit and rational needs or motivations: as several recent studies point out, unconscious and implicit motivations are key components of the complex evaluations we make when choosing what to eat (Hollands et al., 2011; Piqueras-Fiszman et al., 2014; Richard et al., 2019). Indeed, especially in countries were food is available to the large majority of the population and putting together a meal is not a concern for most persons, food choices are not generally driven by the satisfaction of the physiological need. Or, in other words, we do not eat just to avoid starving: we eat and prepare food because it gives us a chance to gather with our family or our dear ones; we choose certain foods because they allow us to express our values and personality (e.g.: by "going vegan", or preferring only foods certificated as sustainable, organic, etc.); we choose and prepare food because it allows us to achieve something meaningful by following a complex recipe.

This can be summarized by a simple, classical statement: "tell me what you eat, and I'll tell you who you are". Eating is, after all, a crucial component of our lives not just because it helps us avoid starving and maintain our bodies operational, but also because it shapes our cultural identity and personality (Castellini & Graffigna, 2022), and is frequently a focal point at social gatherings like marriages, holydays, parties, etc. (Caplan, 1997).

The overall aim of this work is to apply a consumer psychology perspective on food choices, with a particular focus on healthy food choices. Given the already

mentioned complexity of factors that play a role in determining our choices, and given the multi-paradigmatic nature of consumer psychology as a perspective, we will mainly focus on affective, emotional, and dynamic components of our choices (i.e.: engagement, involvement, motivations, and emotions). In particular, for the first part of this work, we will mainly focus on a peculiar group of consumers - chronic patients with a gastrointestinal disease- which suffer a condition that strongly binds health management and food choices. The following paragraphs will discuss more in depth the main psychological constructs that we will study throughout this work, and the case study population of patients with Inflammatory Bowel Diseases (IBD), as well as the structure of the studies presented and their specific aims.

1.2 Food Involvement

The psychological construct that describes and operationalizes the consumers' affective and behavioral commitment towards food is called Food Involvement (Bell & Marshall, 2003): this construct, described as a stable characteristic of a person, is strongly related to how a person puts effort into each phase of the preparation of food, as described by Goody (1982): acquisition, preparation, cooking, eating, and finally disposing. Interestingly, it has been shown that food involvement is associated with different food intake patterns: for instance, Marshall & Bell (2004) demonstrated that people with a higher Food Involvement tend to follow a healthier diet (e.g.: less calories from fat, more calories from fresh fruit and vegetables), and are more prone to seek variety in their meals. Furthermore, a following study (Eertmans et al., 2005) demonstrated that Food Involvement is not only related to specific food choices (i.e.: the reported intake of certain food items), but that it also

relates to different motives behind these food choices: in particular healthiness, mood management, and search for sensory appeal among the others.

1.3 The role of mood and emotions

Beyond the involvement towards food, another important aspect that needs to be addressed when considering food choices is mood. The relationship between emotional state and food intake is rather well established and accepted in literature (Canetti et al., 2002).

In particular, this relationship has been investigated starting, mostly, from clinically obese populations: early studies indeed were aimed at understanding how mood modulated the calorie intake of people with maladaptive nutritional behaviors such as binge eating, as food for them becomes a mean to reduce their anxiety and distress (Kaplan & Kaplan, 1957; Schachter et al., 1968). Indeed, the relationship between poor mood (i.e.: boredom, depression, or fatigue) and higher food consumption or binge eating is well known in literature (AlAmmar et al., 2020), although there is a stronger focus on clinical populations (Cardi et al., 2015). Although recent studies also show that even positive mood might evoke a higher calorie intake (Evers et al., 2013), it also seems that the search for sweet, comfort food is related more to poor mood rather than to joy (van Strien et al., 2013). Overall, literature seems to suggest that, when distressed or affected by negative emotions, human beings tend to prefer sweet and fatty food, resulting in an overall unhealthy diet (Leigh Gibson, 2006). The use of such foods, high in carbohydrates' content, is probably a mean to provide a temporary lifting of mood (Christensen, 1993; Macht & Simons, 2011).

In this perspective, food choices should be regarded as a complex phenomenon, alimented by different motivations and complex decision making processes, that may be rooted in how the persons relate to their food, and what food means in their lives.

1.4 Taking a look into clinical populations: the case of patients with Inflammatory Bowel Diseases

Indeed, as already mentioned, the role of mood and emotions has been mainly studied with regards to clinical populations, as for many clinical populations food and health are more directly and evidently related to each other than it happens in "healthy" citizens. This is particularly true in those subjects which are required to follow (more or less) strict dietary regimes, such as people with diabetes or cardiovascular conditions, patients with a clinically relevant overweight, etc. (Cardi et al., 2015). When it comes to dietary restrictions, however, it is important to acknowledge the possibility that asking patients to stick to a certain diet is somehow different than asking them to adhere to a prescription like, for instance, remembering to take a certain pill. Adhering to a diet actually implies to actively renounce to foods or preparations patients may like or even crave for, that are part of their cultural baggage, and possibly to renounce or to be restricted in social or family gatherings. In other words: it requires a behavioral change that may not only impact life habits and lifestyle, but also values, culture, sociality, personality. This leads to a series of considerations that need to take into account patients' social and cultural background, as well as importance that "pleasurable" food has for them and for their mood.

A peculiar case study -that will be treated throughout this dissertation- in which the bond between health, mood, and food choices is strong, is that of patients with Inflammatory Bowel Diseases (IBD). Inflammatory Bowel Diseases are a series of chronic conditions (namely: Crohn's Disease, Ulcerative Colitis, and Indeterminate Colitis) that affect a person's gastrointestinal trait, and which require a lifelong treatment. These disorders are extremely heterogeneous, and are generally characterized by a variety of gastrointestinal symptoms, which can widely vary across individuals but that generally include: abdominal pain, diarrhea, nausea, weight loss or reduction in appetite, and other symptoms related to a gastrointestinal sufferance (Singh et al., 2011; Yu & Rodriguez, 2017). A recent review reported that European countries are among the nations with the highest prevalence of IBD, alongside North America; moreover -and worryingly- the review revealed that the incidence has been constantly rising since the '90s even in other continents, potentially as a consequence of industrialization and of the consequent changes in nutrition (Ng et al., 2017). The economic burden exerted by IBD on healthcare systems is noticeable: for instance, in 2008 the cost of Crohn's Disease alone in Europe has been estimated to be between 2.1 and 16.7 billion euros, and between 10.9 and 15.5 billion dollars in the US (Peng Yu et al., 2008).

The relevance of these numbers for public health institutions led to growing bodies of research aimed at understanding the causes of these diseases, and the factors that can cause worsening in the health condition of patients. Nevertheless, the causes of IBD are yet to be fully understood (Bernstein, 2017). Literature suggests an interaction between environmental and genetical factors, which lead to an inflammation of the bowels due to an immunological response (Baumgart &

Carding, 2007). More recently, science has been investigating the role of gut microbiota and of nutrition in general of the onset and the development of these disease: indeed, while there is only limited evidence for the effectiveness of specific dietary regimes on the course of the disease (Mentella et al., 2020), it is a common clinical practice to manage the disease through the implementation of nutritional regimes aimed at modulating the intestinal microbiota and at reducing bowels inflammation (Green et al., 2019). Several studies actually demonstrated the importance of food, nutrition and diet in the management of the disease (Hou et al., 2014; Mehrabani et al., 2017), and patients themselves recognize the importance of a proper diet to manage their own symptoms (Cohen et al., 2013). For instance, a recent quantitative study by Kinsey & Burden (2016) surveyed the dietary concerns, beliefs and opinions of a sample of IBD patients. The results of their survey showed that a large part of their sample (42%) indicated that food severely affected their symptoms, and the majority (51%) reported that controlling their diet was an important aspect in the management of the symptoms.

Thus, it is often recommended to these patients to avoid certain foods and to follow different nutritional guidelines, which often require the patient to change their habits and to renounce to certain foods that might trigger their symptoms and worsen their health status. However, as stated before, while there might be cultural differences (Rozin, 2005), food should not only be considered just from the point of view of its nutritional value, but has also for its implications for people's identities and social life (Castellini & Graffigna, 2022; Fischler, 1988; Lupton, 1994). As we have already mentioned, food is a crucial component of our lives that is part our cultural identity, and often part of social gatherings and activities

(Caplan, 1997). Thus, asking patients to change their behaviors regarding food choices may not only restrict them from enjoying some specific foods they like, but could also have a direct impact on their social lives, especially in younger patients (including children and adolescents, as IBD are often diagnosed in minors). Scientific literature indeed suggests a difficulty for IBD patients in regulating their eating behavior, with maladaptive behaviors such as cheating, emotional eating, restrictive eating, and food avoidance, which are often connected to feelings of anxiety, distress, depression, or poor mood (Day et al., 2021; Dubinsky et al., 2021; Wardle et al., 2018).

Given the impact of poor eating behaviors in this population, it becomes relevant to understand the impact that dietary restrictions have on their psychological experience, as experiencing one's illness/nutrition as a limitation can lead to reacting to negative emotions with cravings and wrong eating behaviors, with consequent relapses or worsening of symptoms (Palant et al., 2015).

1.5 A matter of Health Engagement?

As we have discussed in the previous section, food and health are strongly related, especially in some clinical populations such as IBD. Indeed, asking people to change their dietary behaviors in order to live a healthier life may actually require a huge commitment on their part, and might be compared (with the due differences) to asking a patient to adhere to another medical prescription, like taking drugs, increasing physical activity, stop smoking, etc. in terms of how this has the potential to impact their current lives, their habits, their sociality, and their perception of self. When it comes to asking a patient (in the broad sense of a person

with a health need) to adhere to a prescription, be it a dietary change or a pill to take, patient engagement becomes a relevant psychological construct that needs to be taken into account.

Currently, there are several different definitions of patient engagement (Barello et al., 2014): for instance, patient engagement has been defined as the set of behavioral skills that a patient can adopt to self-manage his/her own health and lifestyle (Gruman et al., 2010; Hibbard & Mahoney, 2010), as well as the required knowledge and perceived self-efficacy necessary to adopt a proactive behavior in healthcare (Greene & Hibbard, 2012). Regardless of the specific definition, literature shows that patients with a higher level of health engagement show improved clinical outcomes (Greene et al., 2016; Greene & Hibbard, 2012), reduced costs (Laurance et al., 2014), better health literacy (Barello et al., 2020), and -last but not least- adherence to medication and prescriptions (Chen et al., 2013; Graffigna et al., 2017; Malhotra et al., 2018; Mûnene & Ekman, 2015).

The interest towards this construct is increasing, and its measurement is becoming highly relevant in the approaches based on the paradigm of patient centered medicine (Bensing, 2000; Sacristán, 2013). In this perspective, the patients' expertise becomes a valuable asset in the decision-making process. However, this requires the patient to be capable and willing to play an active role, to be proactive in the relationship with the healthcare providers, and to be capable of autonomously navigate the whole healthcare system in which the patient is: for patient centered medicine to be effective, the patient needs to be engaged (Fruytier et al., 2022; Schechter & Wegener, 2022).

The definition we will stick throughout this work is that given by Barello & Graffigna (2015): the authors define patient engagement as an emotional, value-based, readiness of the person with a health need (e.g.: due to a chronic condition) to play an active role in the management of his/her own health, condition, and lifestyle. This approach represents a step forward from definitions of patient engagement based on a patient's cognition (what he or she knows) and behavioral skills, as it seeks to explore the more personal, psychological underpinnings of how people behave and perform in health management. This definition of patient engagement also tries to understand and describe patients' emotions, values, and motivations, which are important behavioral drivers. In fact, this approach tries to go beyond and above descriptions that are based solely on what a patient knows, what he or she is capable of doing, and what he or she thinks to be able to do (self-efficacy). The Patient Health Engagement model (PHE model) was developed as a result of this concept of patient engagement (Graffigna & Barello, 2018).

1.6 Aims & methodologies

A consumer psychology's perspective may thus contribute in understanding the emotions and motives behind a certain behaviour, in interpreting its value for the person, and hence in developing tailored, personalized strategies for targeting educational content and communication intended to guide or maintain behavioural change. This dissertation will assume this perspective to investigate the connection between food choices, its motives, and the psychological characteristics of consumers. The first part of this work will focus on a peculiar group of patients, for which food choices have a more direct, relevant, and evident impact on health: patients with a diagnosed Inflammatory Bowel Disease. As we will describe below,

the last study will instead describe a group of healthy citizens: the intention is to try to connect what has been observed on a group of patients with a more general group of consumers.

This work will feature three studies: the first study, described in Chapter 2 and already object of publication in Palamenghi et al. (2022), describes a scoping review that aimed at addressing and understanding the impact that food choices and restrictions exert on IBD patients' quality of life and psychosocial wellbeing. The results will show that food restrictions are not a minor concern for these patients, but that indeed are connected with their values, and their difficulty in feeling "normal" and accepting their new lifestyle. Thus, by observing a population that has the prescription to restrict their diet due to health reasons, it becomes clear that food is not just a nutrient, but that it yields for the consumers a whole lot of meanings and attributed that go far beyond the simple functional aspect, and that adherence to such prescriptions impacts on much more than just habits, convenience, and nutrition.

The second study, instead, is based on a web-survey on a rather large sample of Italian IBD patients. The study was conducted thanks to a grant from Nestlé Health Science, and in collaboration with AMICI Onlus, and part of the work is described in a paper currently under peer review. The purpose of the study was to delve deeper into the nutritional habits of Italian IBD patients, their motivations behind food choices, and how these could be linked to behaviors of non-adherence to the prescribed diet. Moreover, the role of Patient Engagement and Food Involvement was also investigated, and results show that these variables can be

used to cluster patients -thus identifying groups of persons with different main drivers behind food choices.

Finally, the third study, builds on the results of the second, and tries to demonstrate how Food Involvement and Health Engagement can be intertwined in determining consumers' reactions towards food, thus potentially influencing their motivations behind food choices. While this study will stray from the IBD population, its value is important in trying to expand some findings to a more general group of consumers. The results of this study will show that -coherently with expectations- involvement toward food is correlated with an emotional activation at the sight of a food stimuli, but that this relation only exists in a subgroup of people with a low engagement towards their own health and healthy eating: this finding might have some interesting implications on how food choices are taken, and how emotions play a role in consumers with different psychological characteristics.

Figure 1 summarizes the overall structure of this work.

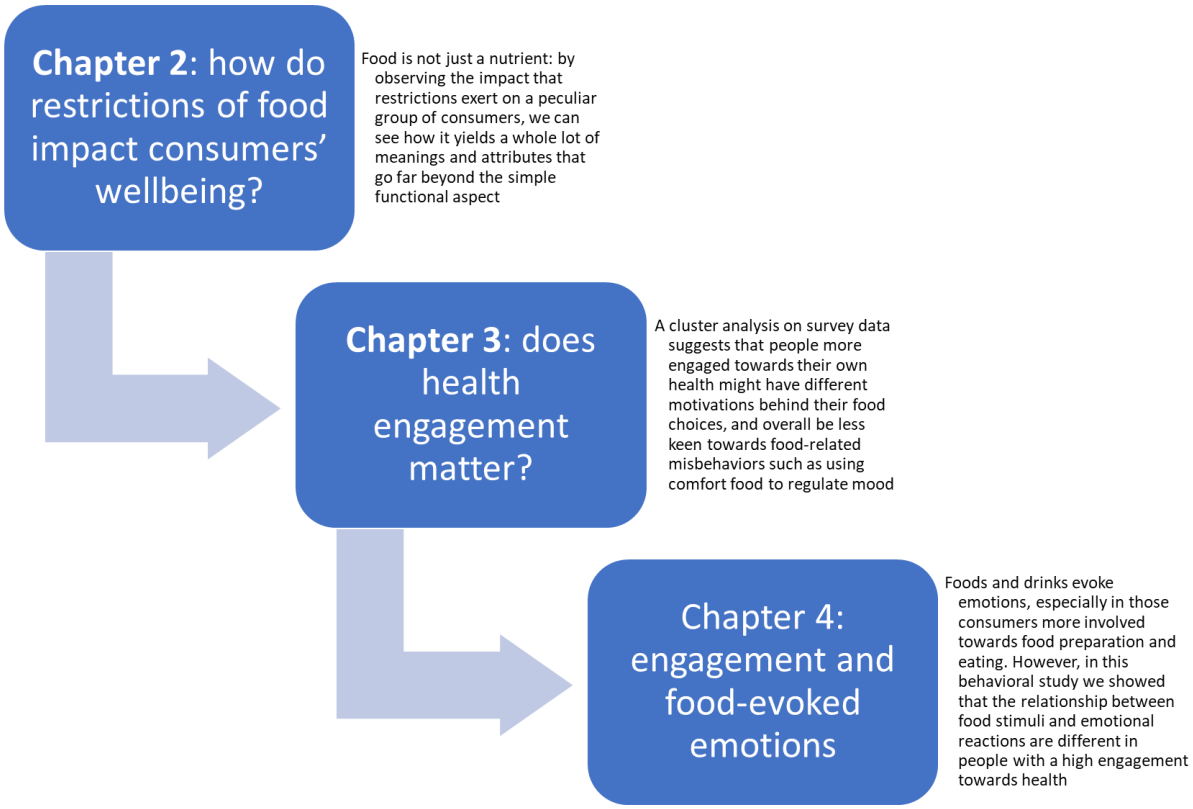

Figure 1: the structure of the thesis

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2. Study 1: A scoping review on the connection between food, mood, emotions, and IBD patients' psychosocial wellbeing

2.1 Study Introduction

As previously stated, there is growing attention in science in the understanding of the role that food and diet plays in determining IBD patients' symptoms and well-being (Hou et al., 2014; Mehrabani et al., 2017), in addition to the pharmacological treatment. Indeed, current guidelines for the treatment of Inflammatory Bowel Diseased generally include dietary recommendations for these patients (Mentella et al., 2020), and growing bodies of literature are dedicated to the identification of the specific foods that are more likely to worsen the patients' health condition (Hou et al., 2014; Limdi, 2018; Uranga et al., 2016).

However, regardless of this growing interest and of the increasing amount of evidence, so far there is only a limited understanding of the mechanisms behind the relationship between IBD and nutrition, and it is often reported by patients that the guidance provided to them by their healthcare providers is limited, regarding which foods they should seek to avoid (Limdi, 2018; Palant et al., 2015). Additionally, as already discussed, food goes beyond mere nutrition, and has a social and cultural value for persons.

Thus, given the relevance of food not only for the clinical aspects of the management of Inflammatory Bowel Diseases, but also for the psycho-social well-being of patients, we decided to do a literature review with the aim of mapping the existing knowledge regarding the aspects of food that impact on the psychosocial wellbeing and the quality of life of IBD patients, in order to delve deeper into the

connection that exists between food, mood and emotions, and quality of life. The results of this first study are also published in Palamenghi et al. (2022).

2.2 Materials and Methods

2.2.1 A scoping review

We did a scoping review to address our research question. Scoping reviews are a methodology developed with the aim of mapping the state-of-the-art of the literature in a certain field (Arksey & O'Malley, 2005), generally with the specific aim of identifying knowledge gaps in the existing literature, while also summarizing the existing evidences regarding a phenomenon. Scoping reviews differ from systematic reviews on a series of aspects, the main one being that they are somehow more flexible in inclusion criteria and thus they generally allow for broader and more general research questions: scoping reviews are not necessarily concerned in screening for the quality of the included studies, and the resulting synthesis is generally more narrative, as opposed to systematic reviews which aim at a more formal mapping of the results, or at a meta-analysis (Armstrong et al., 2011).

In our case, we preferred a scoping review over a systematic review as our research question was rather broad, and the more flexible approach granted by the scoping review methodology was more in line with our aims, while also granting a rigorous way to collect and chart the evidences on how food restrictions and diets in IBD impact on the psychosocial wellbeing and the quality of life of patients.

In order to carry out our scoping review, we used the framework described by Arksey & O' Malley (2005), detailing a procedure in four phases:

1. Identification: in this phase, all potentially relevant studies are identified by interrogating a selection of the major scientific citation databases using a pre-defined search strategy;
2. Selection: in this phase, all the titles and abstracts of the studies included in phase 1 are screened in order to remove those studies that don't meet the inclusion criteria, or that are evidently not relevant for the research question;
3. Data extraction: included studies are then read in full text, and the relevant data are extracted and systematized, while eventual ulterior papers are excluded; eventually, if in the references of the included study emerges one or more papers that could be relevant to the research question but that were not retrieved in the databases interrogation, these papers could be included;
4. Data charting: results are described and synthetized.

A detailed description of the methodology of each phase can be found in the following paragraphs.

Phase 1: study identification

We searched the most relevant scientific databases in the medical, psychological, and psychiatric fields, i.e.: Scopus, Web of Science Core Collection, Pubmed, EBSCO_ Cochrane Central Register of Controlled Trials, and PsycINFO, to find all the possibly pertinent papers to be included in our review. The search was done on January 7, 2021, and it only looked at articles written in English. The search string was made up of three main queries, each of which was made up of several synonyms and connected to other queries with the 'OR' operator. The three queries

included regarded: "Inflammatory Bowel Disease", "Food", and "psychosocial well-being". Then, we checked for duplicate papers by importing all the detected studies into Mendeley, a reference manager. Duplicated entries were removed, and only one instance of each paper was kept.

Phase 2: study selection

The titles and abstracts of the identified articles were then screened using the following inclusion criteria:

1. Included studies ed to discuss the perception of the disease-food relationship in IBD patients, its psychosocial outcomes, or the quality of life derived from such relationship (clinical trials and publications that evaluated specific dietary or medical treatments efficacy, and articles that focused specifically on the nutritional aspects of food were excluded if psycho-social aspects were not taken into consideration);
2. Article were in English, and available either publicly (Open Access), through the researchers' institution's subscriptions, or by the kind concession of the corresponding authors when necessary; articles for which the full text could not be retrieved in neither of these ways were excluded;
3. Literature not peer-reviewed, opinions, letters and other reviews were excluded.

The identified publications were then screened by two team members by reading the titles and abstracts. Consensus was used to settle disputes about inclusion or exclusion.

Phase 3 & 4: data extraction and results reporting

Three different kinds of data were extracted from the studies included in the final selection, and separately charted. The extracted data regarded:

1. *The bibliometric information of the studies*, namely: the full reference, year of publication, the journal and the area of specialization of the journal on which the study was published;
2. *Methodological data:* whether the study described was quantitative, qualitative, or mixed methods; the tools or measures used in the study; the characteristics of the sample, and the nationality of the participants to the study;
3. *Main results of the studies:* as previously described, the aim of a scoping review is to chart and map the evidences in a certain field, and to highlight eventual gaps in the knowledge. For this reason, and given the nature of the included studies, no meta-analysis of the results was carried out. However, a qualitative thematic analysis was conducted, in order to chart the main themes that emerged from the results of the papers reporting qualitative studies, or that were investigated by the included quantitative studies.

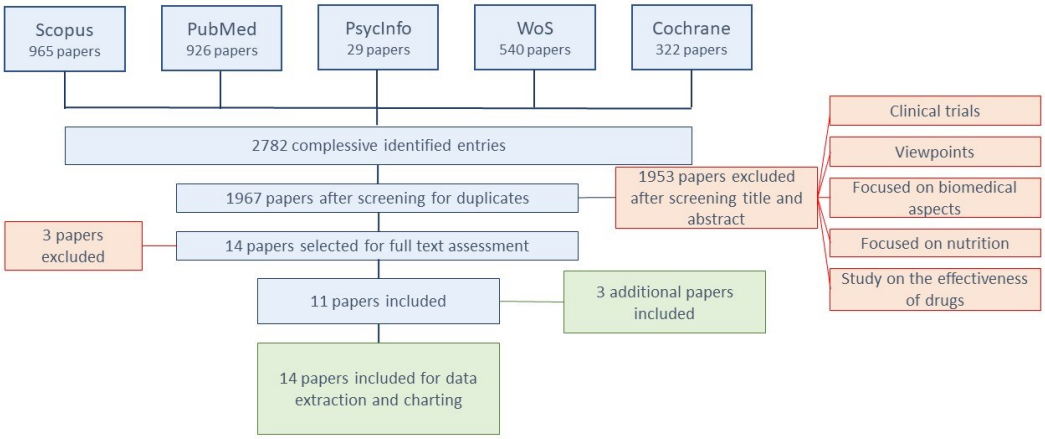
2.3 Results

2.3.1 Identification and selection of the relevant studies

The outcomes of the identification and selection process are displayed in Figure 2. The database search turned up 2782 total entries, which were exported into the citation manager (Mendeley). 1967 publications were left after duplicates were removed (using automatic tools and manual inspection). 1953 articles were

excluded after screening titles and abstracts, as their content was not relevant for our research question. Thus, 14 articles were included as possibly relevant after the initial title and abstract screening and were screened in full text. Three of these papers were later eliminated because they did not meet the requirements for inclusion. However, 3 additional articles that weren't discovered by our search string but were located by looking through the reference lists of papers that were already included were later included as relevant. 14 publications in all were included for the data extraction process.

Figure 2: PRISMA flow chart of the identification and selection procedure.



2.3.2 Characteristics of the included studies

Table 1 summarizes all the bibliometric data and characteristics of the 14 included papers. Among the retrieved and included articles, the oldest that investigates the impact of food in IBD patients is a paper from Jowett and colleagues published in 2004 (Jowett et al., 2004), while the most recent found is dated 2021 (Crooks et al., 2021). All the included studies have been published on

journals specialized in health sciences: in particular, two articles (Limdi et al., 2016; Zallot et al., 2013) were published on a journal highly specialized in Inflammatory Bowel Diseases (i.e.: Inflammatory Bowel Diseases), while three articles (Crooks et al., 2021; de Vries et al., 2019; Palant et al., 2015) were published on journals specialized in gastroenterology (i.e.: *European Journal of Gastroenterology & Hepatology*; *BMC Gastroenterology*; *Digestive Diseases*). The remaining nine articles were published on journals dedicated to nursing, medicine, or quality of life.

Table 1: Bibliometric characteristics of the included papers

AUTOR(S)	TITLE	YEAR	JOURNAL	JOURNAL SUBJECT AREA[A]
Alexakis, C.; Nash, A.; Lloyd, M.; Brooks, F.; Lindsay, J. O.; Poullis, A.	Inflammatory bowel disease in young patients: challenges faced by black and minority ethnic communities in the UK	2015	Health & Social Care in the Community	Medicine: Health Policy; Public Health, Environmental and Occupational Health. Social Sciences: Social Sciences (miscellaneous); Social Work; Sociology and Political Science.
Chuong, K. H.; Haw, J.; Stintzi, A.; Mack, D. R.; O'doherty, K. C.	Dietary strategies and food practices of pediatric patients, and their parents, living with inflammatory bowel disease: a qualitative interview study	2019	International journal of qualitative studies on health and well-being	Medicine: Health Policy. Nursing: Fundamentals and Skills; Gerontology; Issues, Ethics and Legal Aspects.
Crooks, B.; Mclaughlin, J.; Matsuoka, K.; Kobayashi, T.; Yamazaki, H.; Limdi, J. K.	The dietary practices and beliefs of people living with inactive ulcerative colitis	2021	European Journal of Gastroenterology & Hepatology	Medicine: Gastroenterology; Hepatology.
Czuber-Dochan, W.; Morgan, M.; Hughes, L. D.; Lomer, M. C. E.; Lindsay, J. O.; Whelan K.,	Perceptions and psychosocial impact of food, nutrition, eating and drinking in people with inflammatory bowel disease: a qualitative investigation of food-related quality of life	2020	Journal of Human Nutrition and Dietetics	Medicine: Medicine (miscellaneous). Nursing: Nutrition and Dietetics.
De Vries J. H.M.; Dijkhuizen, M.; Tap, P.; Witteman, B. J.M.	Patient's Dietary Beliefs and Behaviours in Inflammatory Bowel Disease	2019	Digestive Diseases	Medicine: Gastroenterology; Medicine (miscellaneous).

Fletcher, P. C.; Schneider, M. A.	Is There Any Food I Can Eat? Living With Inflammatory Bowel Disease and/or Irritable Bowel Syndrome	2006	Clinical Nurse Specialist	Nursing: Advanced and Specialized Nursing; Assessment and Diagnosis; Leadership and Management; LPN and LVN
Guadagnoli, L.; Mutlu, E. A.; Doerfler, B.; Ibrahim A.; Brenner, D.; Taft, T. H.	Food-related quality of life in patients with inflammatory bowel disease and irritable bowel syndrome	2019	Quality of Life Research	Medicine: Public Health, Environmental and Occupational Health
Jowett, S. L.; Seal, C. J.; Phillips, E.; Gregory, W.; Barton, J. R.; Welfare, M. R.	Dietary beliefs of people with ulcerative colitis and their effect on relapse and nutrient intake	2004	Clinical Nutrition	Medicine: Endocrinology, Diabetes and Metabolism. Nursing: Nutrition and Dietetics.
Limdi, J. K.; Aggarwal, D.; Mclaughlin, J. T.	Dietary Practices and Beliefs in Patients with Inflammatory Bowel Disease	2016	Inflammatory Bowel Diseases	Medicine: Gastroenterology; Immunology and Allergy.
Marsh A.; Kinneally J.; Robertson T.; Lord A.; Young A.; Radford–Smith G.	Food avoidance in outpatients with Inflammatory Bowel Disease – Who, what and why	2019	Clinical Nutrition ESPEN	Medicine: Endocrinology; Diabetes and Metabolism. Nursing: Nutrition and Dietetics.
Palant A.; Koschack J.; Rassmann S.; Lucius-Hoene G.; Karaus M.; Himmel W.	"And then you start to loose it because you think about Nutella": The significance of food for people with inflammatory bowel disease - a qualitative study	2015	BMC Gastroenterology	Medicine: Gastroenterology; Medicine (miscellaneous).
Pituch-Zdanowska A.; Kowalska-Duplaga K.; Jarocka-Cyrta E.; Stawicka A.; Dziekiewicz M.; Banaszkiewicz A.	Dietary Beliefs and Behaviors Among Parents of Children with Inflammatory Bowel Disease	2019	Journal of Medicinal Food	Medicine: Medicine (miscellaneous). Nursing: Nutrition and Dietetics.

Schneider Margaret A.; Jamieson A.; Fletcher P. C.	'One sip won't do any harm . . .': Temptation among women with inflammatory bowel disease/ irritable bowel syndrome to engage in negative dietary behaviours, despite the consequences to their health	2009	International Journal of Nursing Practice	Nursing: Nursing (miscellaneous).
Zallot C.; Quilliot D.; Chevaux J. B.; Peyrin-Biroulet C.; Guéant-Rodriguez R. M.; Freling E.; Collet-Fenetrier B.; Williet N.; Ziegler O.; Bigard M. A.; Guéant J. L.; Peyrin-Biroulet L.	Dietary Beliefs and Behavior Among Inflammatory Bowel Disease Patients	2013	Inflammatory Bowel Diseases	Medicine: Gastroenterology; Immunology and Allergy.

[A] journal subject area was retrieved from: scimago (https://www.scimagojr.com/)

Half of the included articles described quantitative research (Crooks et al., 2021; de Vries et al., 2019; Guadagnoli et al., 2019; Limdi et al., 2016; Marsh et al., 2019; Pituch-Zdanowska et al., 2019; Zallot et al., 2013), while 6 described studies based on qualitative methodologies (Alexakis et al., 2015; Chuong et al., 2019; Czuber-Dochan et al., 2020; Fletcher & Schneider, 2006; Palant et al., 2015; Schneider et al., 2009). Only one study employed mixed methodologies (Jowett et al., 2004).

Regarding the sample, three articles included in the study (Fletcher & Schneider, 2006; Guadagnoli et al., 2019; Schneider et al., 2009) featured a mixed sample of both IBD and IBS (Inflammatory Bowel Syndrome) patients. Even though IBD and IBS are different pathologies, with their own peculiarities and characteristics, we chose to include these studies as well since the authors themselves believed that IBD and IBS patients were comparable with regard to their dietary limitations and the effects those limits have on their psychological health. Nevertheless, only information relevant to IBD patients was taken from these studies and summarized, wherever it was practical.

Finally, it is interesting to notice that only a small minority of the included studies considered also young patients: two studies (Alexakis et al., 2015; Czuber-Dochan et al., 2020) included adolescent over 16 years old along with adults; the study from Chuong et al. (2019) included participants aged between 9 and 17 years old, along with their parents; finally, one study (Pituch-Zdanowska et al., 2019) investigated young IBD patients' lives through the proxy of the parents. The remaining studies only considered adult patients.

The remaining 10 studies were all limited to investigating adult patients. Every included study was carried out in western nations, although one article (Alexakis et al., 2015) was focused on black and minority ethnic groups in the UK. Table 2 summarizes the included studies' methodology (quantitative, qualitative, or mixed), research methods, and sample characteristics.

Table 2: Included studies' methodology, research methods, and sample characteristics

REFERENCE	METHODOLOGY	RESEARCH METHODS	SAMPLE SIZE	SAMPLE IBD TYPE	SAMPLE AGE/AGE GROUPS	SAMPLE COUNTRY
Alexakis et al., 2015	Qualitative study	Semi-structured interviews with young people with IBD from black and minority ethnic groups	20	CD (13), UC (6), other (1)	16-24	UK
Chuong et al., 2019	Qualitative study	Semi-structured interviews with children and their parents or grandparents	28	CD (23), UC (5)	Children and adolescents (9-17)	Canada
Crooks et al., 2021	Quantitative study	Questionnaire developed by the authors (27 questions)	208	UC	≥18	UK
Czuber-dochan et al., 2020	Qualitative study	Semi-structured interviews conducted with people with IBD	28	CD (16), UC (12)	≥ 16	UK
De vries et al., 2019	Quantitative study	Questionnaire developed by the authors (37 close-ended questions)	294	CD (146), UC (148)	18-79	Netherlands
Fletcher & schneider, 2006	Qualitative study	Semi-structured interviews with women with IBD or IBS	8	2 UC, 1 UC+IBS, 5 IBS	18-22	Canada

Guadagnoli et al., 2019	Quantitative study	Survey including measures of Food-Related Quality of Life, Health-Related Quality of Life, disease activity, anxiety and depression	175	IBD (95), IBS (80)	18–70	USA
Jowett et al., 2004	Mixed method: qualitative assessment of nutritional beliefs and a quantitative assessment of nutritional intake	Interview at recruitment (beliefs) + food frequency questionnaire (nutritional intake) at recruitment and once a week for 1 year + validated disease activity index at recruitment and once a week for 1 year	191 (follow-up complete in 183 patients)	UC	18-70	UK
Limdi et al, 2016	Quantitative study	Questionnaire developed by the authors (demographics +18 questions relating to dietary beliefs and food related behavior)	400	CD (156), UC (205), not sure or no response (53)	>18	UK
Marsh et al., 2019	Quantitative study	Structured interviews with patients with IBD including nutritional assessment and evaluation of medical records	117	CD (50), UC (61), unspecified (6)	>18	Australia

Palant et al., 2015	Qualitative study (grounded theory)	Open-end narrative interviews conducted with people with different IBD types, disease activities, and prior surgeries	42	CD (25), UC (15), IC (2)	Young adults, Middle aged and Aged people	Germany
Pituch-zdanowska et al., 2019	Quantitative study	Questionnaire developed by the authors administered to parents of children with IBD (demographics and disease characteristics + 13 questions about dietary beliefs and practices + list of products avoided or that should be avoided)	155	CD (104), UC (51)	4-8	Poland
Schneider et al., 2009	Qualitative study (phenomenological study guided by heuristic inquiry)	Semi-structured interviews with women with IBD or IBS + background questionnaire + food diary	3 IBD and 5 IBS	3 IBD (1 CD, 1 UC, 1 CD+UC), 5 IBS	18-23	Canada
Zallot et al., 2013	Quantitative study	Questionnaire developed by the authors (14 questions relating to dietary beliefs and dietary behavior)	244	CD (177), UC (67)	>17	France

2.3.3 Main results and emerged themes

Even though there are contrasting evidences, the studies analyzed in our scoping review indicate that at least some patients consider nutrition as a key component of their own illness management. Indeed, although some studies report lesser percentages of patients who held this viewpoint (13%-16%) (de Vries et al., 2019; Zallot et al., 2013), different studies (Crooks et al., 2021; Limdi et al., 2016) reported that a significant portion of participants (31%-48%) felt that nutrition is a probable cause of their inflammatory bowel disease (IBD), and a higher proportion (33%-58%) reported that they believe food to be an important trigger for relapses.

In particular, one of the retrieved studies (Pituch-Zdanowska et al., 2019) reported that the belief that food plays an important, fundamental role in causing relapses is much more present among parent of children with IBD than among adult patients. Additionally, the authors also found that dietary beliefs seem to be perceived differently by parents depending on age and length of illness: parents of children with a longer history of IBD tended to respond more frequently that food could be the cause of the illness, and parents of older children expressed greater concern that dietary habits could cause an IBD flare-up.

Overall, several patients in the included studies considered adapting their dietary intake to control the symptoms, prevent, or end the relapses faster; moreover, a large number of patients (21%–59%) reported diet as equally or more important than medicines in the management of the disease (de Vries et al., 2019; Limdi et al., 2016; Marsh et al., 2019). Finally, Crooks et al. (2021) found that

about 30% of the patients participating in their study was convinced that what they decided to eat or drink was fundamental in the prevention of future relapses. Coherently with these findings, the qualitative study from Czuber-Dochan et al. (2020) found that many patients believe that there is a two-way relationship between IBD and food: on the one hand, the condition may have an impact on their eating patterns, and on the other hand, dietary strategies may be an effective means of treating the symptoms. Although food was not directly linked to IBD flare-ups in this study, most patients thought particular meals or food groups would make their symptoms worse, especially when the disease was in an active phase.

According to the included studies, the majority (59%-90%) of the patients (especially patients with CD compared to patients with UC, according to Marsh et al., 2019) implement strategies to reduce symptoms or prevent relapses based on the avoidance or reduction of certain foods (Crooks et al., 2021; de Vries et al., 2019; Limdi et al., 2016; Marsh et al., 2019; Pituch-Zdanowska et al., 2019; Zallot et al., 2013), although in certain cases patients reported not following specific guidelines or dietary patterns (Marsh et al., 2019). The majority of studies' findings concur that very popular food groups like spicy foods (44% to 81%), fat or strongly seasoned foods (32% to 70%), food containing lactose, carbonated beverages, milk and other dairy products, raw vegetables, raw fruits, and fibers are the most frequently left out (de Vries et al., 2019; Jowett et al., 2004; Marsh et al., 2019; Zallot et al., 2013). Believes concerning foods also include a list of foods that are deemed as potentially beneficial to IBD patients' health, as reported by de Vries et al. (2019): wholemeal bread, tea, leafy vegetables, fatty fish, and poultry. Moreover, according to several studies (Crooks et al., 2021; de Vries et al., 2019; Guadagnoli

et al., 2019), the use of dietary supplements is generally reported as a very common strategy for the improvement of health and the reduction of fatigue in IBD patients, especially during relapses. In particular, the results from Crooks and colleagues (2021) show that about 1 patient with UC out of 4 tries a specific whole food exclusion diet, and 12% excluded more than one food from their diet; participants in this study reported that lactose-free and gluten-free diet were among the most common. Coherently, Zallot et al. (2013) reported that only about 25% of the patients didn't change their diet during relapses, while more than 50% changed their diet in favor of a low-residue diet. Changing food preparation to make meals easier to digest, substituting "bad foods" with "good foods", eating slowly, and regulating intake of particular foods without completely excluding them were other symptom prevention techniques that emerged from the qualitative studies (Czuber-Dochan et al., 2020; Fletcher & Schneider, 2006).

However, adhering to a strict diet is not an easy task, especially when it might cause social embarrassment or when it comes to foods that patients crave for: indeed, several studies report that "cheating" -particularly among younger patients- is quite common in IBD patients (Chuong et al., 2019; Fletcher & Schneider, 2006; Palant et al., 2015; Schneider et al., 2009). Coherently, some accounts of patients claim that they base their own food decisions solely on their preferences, despite the (foreseeable) consequence of having to use the restroom more frequently, as they did not feel like they could deprive themselves of the pleasure of eating certain foods and they believed that living their pre-diagnosis lives and eating "normal" food made them feel more "normal" (Czuber-Dochan et al., 2020; Palant et al., 2015; Schneider et al., 2009).

Our thematic analysis showed that three different aspects of patients' quality of life -their personal and psychological wellbeing, social life, and family sphere- were impacted by these strategies implemented (i.e.: the perceived need to abstain from particular food categories, and the attention that patients must pay to food preparation and consumption). Table 3 lists the primary conclusions from the quantitative investigations and the topics from the qualitative research, organized into the 3 recognized thematic areas, and the following paragraphs discuss these three main areas of patients' quality of life more in detail.

Personal and Psychological wellbeing

Although avoiding trigger foods appears to be an effective way to lessen the frequency of relapses and flare-ups, patients have also reported in numerous studies that having to pay closer attention to what they eat has an impact on their daily lives. Many of them reported finding it difficult to manage their daily activities as a result of the need to modify their diet to control IBD symptoms; in fact, many patients reported having to carefully plan their daily activities (Alexakis et al., 2015; Chuong et al., 2019; Czuber-Dochan et al., 2020; Palant et al., 2015). Because of how time-consuming this meticulous planning is (Czuber-Dochan et al., 2020), people who must continually monitor and restrict their eating habits may experience frustration, dissatisfaction, and, ultimately, distress (Czuber-Dochan et al., 2020). Indeed, a study (Guadagnoli et al., 2019) found that a participant's food-related quality of life was negatively correlated with the number of different diets they were following. This is concerning because the same study found that two out of three IBD patients were following at least one diet at the time of the study, and many of them were following multiple diets. In other situations, food restriction

turned out to be an unsuitable approach, resulting in significant weight loss and ongoing exhaustion (Czuber-Dochan et al., 2020).

The confusion brought on by the challenge of locating trustworthy and dependable sources of information regarding food also appears to have an effect on the patients' psychological and emotional wellbeing. In fact, it appears that testing, going through a "trial and error" process, and paying attention to one's own body's responses are some of the most popular approaches to determine trigger foods (in both adult and pediatric patients) (Chuong et al., 2019; Czuber-Dochan et al., 2020). However, this complexity and the knowledge that sacrifices and limitations don't always work leave some patients feeling dissatisfied, distressed, and dubious, which may lead to non-adherence and a worsening of symptoms from a lack of diet control (Czuber-Dochan et al., 2020; Palant et al., 2015). Results from the study by Chuong and colleagues (2019), in particular, showed that the list of trigger meals or food categories differed greatly amongst young participants, and that the identification of trigger foods is typically lived as a personal experience from the patients. Indeed, one of the most frequent sources of knowledge that patients need to rely on about nutrition and food is personal experience (Limdi et al., 2016; De Vries et al., 2019); while there are several accounts of patients who received dietary advice from healthcare professionals, the most common being the dietician and the gastroenterologist (de Vries et al., 2019; Limdi et al., 2016; Marsh et al., 2019; Zallot et al., 2013), in the study from Crooks and colleagues (2021) the vast majority of the participants (90 percent) that are adopting avoidance strategies to prevent further relapses stated that they based their choices mostly on their own experience with certain products. Moreover, De Vries and colleagues (2019) found

that the internet was the most often used resource for information on food for IBD patients, followed by a dietician and the hospital's treating medical expert. According to Marsh et al. (2019), patients who were in remission were more confident with the advice from the gastroenterologist, compared to both the dietician and the internet; on the other hand, participants who had an active disease showed greater confidence in advice obtained from the internet, followed by the gastroenterologist, the dietician, and the general practitioner. Limdi and colleagues' investigation (2016) revealed that about 50 percent of their subjects never got any dietary guidance. This pattern appears to be different for pediatric patients: one study actually found that nearly all parents of children with IBD (91%) had received nutritional advice and were more likely to rely on medical professionals (74%) and dieticians (70%) than other sources, even though many of them also acknowledged looking for information from non-professional sources (85%) (Pituch-Zdanowska et al., 2019). Less than half (41%) of IBD participants had ever visited a dietician for a prescribed diet, according to Guadagnoli and colleagues (2019); meeting with a dietician, however, did not necessarily enhance the quality of life of patients with regard to food.

Not all of the included papers mention this difficulty in finding information about diet and food, and in fact some studies claimed that most participants quickly obtained dietary guidance and were happy with it (De Vries et al., 2019; Pituch-Zdanowska et al., 2019). However, many patients in other studies expressed concerns about their lack of understanding of how diet affects their IBD: in one study, for example, the patients found that the advice received from their gastroenterologists and dieticians was frequently hazy, ineffective, and occasionally

even contradictory (Czuber-Dochan et al., 2020). Indeed, in another study (Palant et al., 2015) lack of access to reliable sources of information and having to rely on trial-and-error techniques were reported as sources of uncertainty and frustration, and the majority of participants reported that they received this very same advice from their own healthcare providers.

Finally, the dietary limitations have an effect on how much enjoyment IBD patients get from eating. Only three quantitative studies examined how IBD affected appetite and enjoyment of food; regrettably, in these studies, roughly half of the adult participants (45 % to 66 %) reported that the disease affected their appetite and enjoyment of food and that they were forced to deprive themselves of foods they really liked in order to prevent relapse (Limdi et al., 2016; Marsh et al., 2019; Zallot et al., 2013). The loss of pleasure and appetite was more pronounced in CD patients (87%), compared to UC patients (66%), and appetite diminished during relapse, as opposed to remission (Limdi et al., 2016). The same loss of pleasure in eating was reported for young patients too (Pituch-Zdanowska et al., 2019): pediatric patients may view food abstention as a sacrifice. One in three parents thought that their kids avoided foods they really liked out of concern that doing so would have made their symptoms worse. Additionally, parents of kids with IBD who have had the disease for a shorter period of time were more likely to think that their kids enjoyed their food less than before the illness started. Fried foods, sweets, fast food, milk and dairy products, and salty snacks were among the items parents cited as being more "difficult to avoid" since they were frequently requested by young patients.

Social life

In addition to how it affects their personal lives and psychological welfare, also patients' social lives are impacted by their need to monitor what they eat and avoid particular foods. For instance, according to one study (Pituch-Zdanowska et al., 2019), 44% of the parents of IBD patients who were surveyed believed that the condition and the potential for flare-ups were the major reasons why their kids avoided eating out; in particular, females were found to decline outdoor dining more frequently than boys. This may be worsened in ethnic groups where sharing food is more culturally significant: in a study on minorities in the UK, several interviewed patients described having to decline participation in rituals and social activities where food had a culturally significant impact (Alexakis et al., 2015). This is true not only for young patients, but also for adults, as various studies have shown how the work environment and social events can pose significant challenges for people with IBD (Alexakis et al., 2015; Czuber-Dochan et al., 2020; Palant et al., 2015): for example, some patients felt they had to control their disease by preparing their own lunch at home, eating less, or avoiding eating with colleagues at their workplace (Czuber-Dochan et al., 2020). The fact that patients must eat at relatively specific times with precise food portions limits their ability to enjoy a meal away from home (de Vries et al., 2019). It has been stated that approximately one out of every four patients (21% - 23%) refuses to eat out in order to avoid relapses (Crooks et al., 2021; Limdi et al., 2016; Zallot et al., 2013).

Family sphere

Finally, the necessity for a special diet has an influence on patients' relations with the family. Concerning young patients, it has been reported that some parents,

or even entire families, adapted to their children's diets, thus avoiding the same foods that are potentially harmful to the children themselves. Alternatively, it has often been reported that parents might prepare separate dishes, although only slightly different, giving the patient the impression of eating 'the same thing' as the other members of the family (Chuong et al., 2019). In the same study, some of the parents of children with IBD mentioned that they managed to maintain a "normal" regimen of food habits for their family, while also supporting their children's needs due to their IBD. In fact, many parents interviewed reported being careful during grocery shopping and buying mainly products they knew would be healthy for their children.

On the other hand, although it was occasionally viewed as stressful, between 19 and 28 percent of adult patients in other studies stated that they typically do not eat the same meals as the other family members and have a propensity to prepare and eat separate meals (Czuber-Dochan et al., 2020; de Vries et al., 2019; Palant et al., 2015). According to one qualitative study, this was also linked with the young participants' feelings of guilt since they reported to feel like a burden to their own families because it took more work to meet their needs (Alexakis et al., 2015).

Table 3: Themes investigated by the authors of the included studies

REFERENCE	DIETARY BELIEFS	DIETARY STRATEGIES	DIETARY BEHAVIOR/EVERYDAY PRACTICE	DIETARY KNOWLEDGE/SUPPORT	PSYCHOLOGICAL FACTORS
Alexakis et al., 2015			Patients reported difficulties with food types associated with their cultures, (e.g. not fasting during Ramadan); different meals to those of their family members; avoidance of large social functions.	Lack of awareness of IBD in primary care; general satisfaction of the IBD multidisciplinary team and the level of hospital service; language barriers affect parents' capacity to provide appropriate support for their children	Bullying at school (disease-specific harassment); feeling of anxiety and social exclusion caused by the avoidance of foods relevant to cultural identity; sense of guilt of patients towards their families for having to make a special effort to accommodate their dietary requirements
Chuong et al., 2019		food avoidance and moderation; following a specific diet; healthy eating	impact on grocery, shopping, meal planning, and cooking		maintaining routine and normality
Crooks et al., 2021	31% of participants believe that diet was the initiating factor of their UC and 37% are convinced that diet triggered a relapse of their disease. The main source of these beliefs is participants' own experience. The most commonly identified trigger foods are spicy foods (44%) and fatty foods (40%). Just 54%	Most of the participants (59%) reported avoiding certain foods or drinks at least sometimes; 98% of them avoid more than one dietary product. Almost a quarter of participants (24%) had tried a specific whole food exclusion diet and 12% had tried more than one of this kind of diets.	28% of those who live with family (n=164) avoided eating the same meal as the rest of the family at least sometimes. 21% of participants avoided eating out at list sometimes.	The main source that guide food avoidance is participants' own experience (90%), followed by healthcare professional (19%) and the internet (11%). For those who consumed specific foods, drinks or nutritional supplements (n=34), their main source of information was their own experience (76%),	

	of participants believe that dietary advice during relapse and that during remission were different. 29% are convinced that consuming nutritional supplements or specific foods and drinks could prevent a relapse.			internet (53%) and advice from healthcare professional (24%). Less than half of the participants (48%) reported being able to find dietary advice for UC and 60% of those that could, used internet as source of information.	
Czuber-dochan et al., 2020	Perception of the relationship between food and IBD: the disease affects the diet, but diet itself is perceived as a functional way to control the disease.	"experimenting" with food intake to manage symptoms; food avoidance, food exclusion and food substitution; replacing "bad foods" with "good foods"; frequency of eating, portion sizes and planning ahead; healthy eating, vitamins and minerals; eating preferred food and dealing with consequences	Being organized, shopping, recipes and food preparation; impact on family, personal and professional life; social occasions and eating out	Not knowing enough; conflicting information regarding food in IBD; health professionals, family and friends as source of information and support; limited sources of information and support	Accepting new situation and "normalization"; Being in control; missing the pleasure of being unrestricted about eating and drinking
De vries et al., 2019	Only 13% of the patients think that diet is the most important cause of their IBD and 33% believe that nutrition plays an important role in causing relapse. However, 40% of all participants believe that adapting their dietary intake can end	48% of participants reported to have followed a special diet for their IBD and 76% avoided certain foods in order to reduce symptoms. Most omitted food categories were spicy foods (75%), strongly seasoned foods (70%), carbonated drinks (56%), milk and	Nutrition and lifestyle adaptations to reduce disease symptoms mainly reported by the participants included regular mealtimes (65.2%), sports and exercise (60.8%), more frequent smaller portions (42%) and relaxation (41%).	The majority of participants reported that the main source of their nutrition knowledge related to their IBD was based on own experience (81%), followed by the Internet (37%), the dietician (25%) and the treating medical specialist in the hospital (24%). Of the	

	the relapse faster. 29% expect to gain more control over the disease through nutrition in the future. The majority of respondents (62%) reported that they successfully control their symptoms by adapting their nutrition, 30% of whom only during remission and 27% almost always. 59% of the patients believe diet to be either more (12%) or equally important (47%) compared to their medicine. 61% believed IBD decreases appetite, mainly only during relapse.	other dairy products (52%). More than half of respondents (57%) consumed certain dietary products more frequently in order to have a beneficial effect on their disease symptoms. The most common food that was consumed more by 56% of the participants was wholemeal bread, followed by tea (47%), leafy vegetables (44%), fatty fish (42%) and poultry (39%). Dietary supplements were used by 68% of the patients.		participants who had received dietary advice, more than 70% were satisfied.	
Fletcher & schneider, 2006		Avoidance of "trigger" foods/beverages; use of pills to prevent an episode; pay the consequences after consuming "trigger" foods; eating healthy; keep a food-diary; continuous learning process (trial & error)	Being away from home and problems associated with food and travel		Uncertainty causes frustration; stressful situations trigger symptoms after eating

Guadagnoli et al., 2019	IBD patients reported better FRQoL than IBS patients, with a medium effect size (d = 0.56). IBD patients in remission demonstrated higher FRQoL than IBD and IBS patients with active disease. IBD and IBS patients with active disease did not differ in FRQoL.	Overall, IBS patients, compared with IBD patients, were more likely to use dietary treatments. Interestingly, self-directed dietary therapy was most used by patients in this study, rather than adherence to a well-described diet. Concurrent multiple diet use occurred in 33% of IBD and 36% of IBS patients at time of study; the maximum simultaneous diets used were three in 11% of subjects. The more diets a patient used, the poorer FRQoL for both, IBS and IBD patients. Less than half of subjects reported ever meeting with a dietitian regarding dietary treatment for their disease. IBD patients were more likely to have met with a dietitian. However, meeting with a dietitian did not translate to improved FRQoL.

Jowett et al., 2004	39% of patients, when interviewed, believed that certain foods had been responsible for triggering a relapse at some time. Patients' food beliefs were determined when they were in remission and related to their habitual diet. The majority (68%) of patients believed that food plays a role in their colitis and reported that they ate more or less of a particular food because of it. 49% avoided certain foods, 22% ate more of foods that they believed helped their colitis and 39% thought that certain foods triggered a relapse.	Of those who avoided certain foods (49% of participants), only 24% limited the intake of just one dietary product, the rest avoided two or more foods. The most common foods that patients avoided were milk or dairy products, then fruit and vegetables.	patients who believed that food was important had received dietary advice; most common source of advice was from dieticians

Limdi et al, 2016	48% believed that diet initiates the disease and 57% believed that food has a role in triggering a relapse. Dietary habits are perceived do be more important than medicines in the control of the disease for 28% of participants.	56% of participants modified their diet after the diagnosis and 68% avoided certain food types to prevent a relapse. The most avoided dietary products are spicy foods (45%) and fatty foods (32%). 60% of participants stated that these food categories are implicated in worsening of symptoms.	23% of participants do not share the same menu as the other members of the family and 20% refuse outdoor eating in order to prevent relapse.	Half participants (50%) stated that they had never received any nutritional advice; those who received any identified as the main sources of information dietician (31%) and gastroenterologist (17%). However, most of the participants (67%) are keen on receiving further dietary advice and the preferred sources of information are dietician (45%), IBD nurse specialist (36%), gastroenterologist (29%) and information leaflets (27%).	66% of participants stated that they deprived themselves of their favorite foods in order to prevent relapse and 73% reported that IBD changed their appetite and pleasure in eating. Appetite decreased during relapse and improved outside relapse. More CD patients felt that the disease affected their appetite (87% in CD vs. 66% in UC).
Marsh et al., 2019	, dietary habits vs. medicine	food avoidance (number and type of food groups avoided, reasons for food avoidance)		Source and confidence in dietary advice	Belief that IBD affected the appetite and pleasure of eating
Palant et al., 2015		food avoidance, "listen for their own bodies", learning process: find out the food products they could tolerate, fear/aversion towards eating and drinking, risk of malnutrition	Difficulties when attending ceremonies; have to cook different meals for themselves and their families; concerns about travelling due to the lack of opportunities for cooking own food	professional help as further source of uncertainty (some patients found helpful the brochures given by their doctors, other did not feel supported by the health system)	Eating: between craving and aversion (difficult to abstain from certain products, eating preferred food and dealing with consequences, fear of eating/drinking); Being different (difficulties when attending ceremonial occasions/social events, eating differently from

					their family, concerns about travelling)
Pituch-zdanowska et al., 2019	Parents of children with a longer history of the illness indicated more frequently that food habits could cause their child's illness and parents of older children expressed greater fear that food can trigger an IBD flare.	Among foods that children with IBD avoided were fast food (83%), soft cheeses (83%), vegetable vinegar pickles (83%), hot spices and spicy foods (82%), and carbonated and noncarbonated soft drinks (79%).	Parents of the children with a longer history of the illness more frequently admitted that their child shared the same menu as the other members of the family. In the opinion of 44% parents, the disease was the reason why the child feared or refused outdoor dining, with girls avoiding outdoor dining more often than boys.	More than half of parents thought that children with IBD required care from a dietician and claimed that nutritional advice from a registered dietician was easily available. Almost all responders received nutritional instruction. As a source of knowledge about diet, parents most often mentioned the doctor (74.3%) and/or dietician (70.1%), but they also sought information from nonprofessional sources (84.7%).	Parents of children who suffered from IBD for a shorter period of time more often believed that children currently derive less pleasure from eating than before the illness. 1/3 of all participants believed that their children avoided some products they like because of fear of exacerbating the disease. 65% of respondents agreed that their child avoided foods they really liked: mainly fried dishes, sweets, fast food, milk and any milk products, and salty snacks.

Schneider et al., 2009					Giving into temptations (Cost–benefit analysis: denial/magical thinking; pursuit of normalcy, blatant disregard, purposeful actions; Physical and psychological reliance on medications: proactive behaviors (or over-the-counter medications as insurance, dependent behaviors (or over-the-counter medications and mind games); Awareness and timing of surroundings: comfort of home, fear of unfamiliar/uncontrollable surroundings)
Zallot et al., 2013	Just 16% of participants believed that diet could initiate the IBD, but most patients (58%) believed that food can be a risk factor in causing relapse.	Mostly avoided dietary products are too spicy foods (81%), too fatty foods (49%), raw vegetables (48%), carbonated beverages (45%), raw fruits (44%) and fibers (41%). During relapse, patients tended to exclude more foods and only 25% of participants maintained a normal diet; most respondents (52%) followed a low residue diet.	22% of respondents declared refusing outdoor dining for fear of causing relapse and 19% reported not sharing the same menu as other members of the family.	73% of participants reported having received nutritional advice. The main sources of dietary recommendations were dietitian (47%) and gastroenterologist (44%). More than half of participants (53%) would like to receive some advice on diet.	The majority of participants (48%) stated that the disease had changed their pleasure of eating. This is more evident in CD than in UC patients (54% vs. 38% respectively). Decreased appetite was reported during relapse compared to remission. 67% of participants reported avoiding certain foods they like in order to prevent relapse.

2.4 Discussion

The scientific world is increasingly acknowledging how diet affects the development of chronic illnesses. This connection is even more clear in the case of gastrointestinal conditions like IBD. This highlights the importance of patients' dietary decisions as a key element influencing the clinical course of the condition. Particularly, the significance that patients' dietary decisions play in the treatment of IBD is becoming more and more recognized, both for its influence on the course of the illness and the control of its symptoms (Green et al., 2019; Hou et al., 2014; Kinsey & Burden, 2016; Mehrabani et al., 2017). Indeed, patients' accounts and experiences seem to confirm that their food choices have an important role in the management of their disease (Cohen et al., 2013; de Vries et al., 2019; Limdi et al., 2016; Marsh et al., 2019).

Although crucial, there is still some debate and ambiguity around the dietary recommendations that IBD patients should follow when managing their diet. As a result, patients may adhere to "self-directed" diets in which they make dietary decisions based on their emotional status and unfounded convictions rather than a professional understanding of how nutrition affects their condition. Despite the lack of a clear consensus, we observed from the studies included in our literature review that spicy and fatty meals, carbonated beverages, and milk and its derivatives are typically avoided by IBD patients. Along with meals high in fiber, fresh vegetables and fruits are included in the list of foods that are frequently mentioned as being avoided. This is consistent with findings from a previous systematic review on dietary advice for people with inflammatory bowel disease: the authors reported

that foods that are frequently discouraged include spicy and fatty foods, raw vegetables, dairy products, and foods with a high content of fiber overall (Hou et al., 2014).

The patients' perceived impact of diet on quality of life is a significant factor in these patients' food choices (and related spontaneously oriented food restrictions): the consequences of food consumption in terms of perceived psychological wellbeing, social inclusion, and quality of life are frequently at the core of the patients' individual decisions regarding their diet. Indeed, our scoping review confirmed that patients share the belief that food is an important aspect in determining their own wellbeing (Cohen et al., 2013; Limdi et al., 2016; Marsh et al., 2019; De Vries et al., 2019), which leads them in engaging in restrictions and avoidance for foods which they subjectively believe to be the cause of relapses and worsening of symptoms (Crooks et al., 2021; Limdi et al., 2016; Marsh et al., 2019; De Vries et al., 2019; Zallot et al., 2013).

However, patients (especially younger ones) frequently experience social exclusion, loneliness, and prejudice due to self-imposed limitations and concerns about the effects of food consumption on the severity of their symptoms (Alexakis et al., 2015; Pituch-Zdanowska et al., 2019). Young patients report that self-imposed food restrictions have a negative effect even within the family. In fact, our scoping review retrieved evidences of complex familiar situations caused by the nutritional needs of IBD patients, like the need to spend time and effort on preparation and the ensuing feeling of "exclusion" from typical family dynamics and of sense diversity (Czuber-Dochan et al., 2020; de Vries et al., 2019; Palant et

al., 2015). Literature demonstrates how patients often create individualized systems to monitor their diet and steer clear of things deemed to be "hazardous." Patients must be extremely careful about what, when, and how much they consume; however this comes at a cost: in fact, this makes it harder to manage social interactions and personal time (Czuber-Dochan et al., 2020).

The source of information regarding food and nutrition is another (indirect) stressor for IBD patients. According to several studies, patients must primarily rely on their own knowledge, trial and error, and even potentially unreliable sources of information like the internet in order to develop their "knowledge" and expertise of the foods they need to avoid (de Vries et al., 2019; Guadagnoli et al., 2019; Limdi et al., 2016; Pituch-Zdanowska et al., 2019). Indeed, literature included in the review also demonstrates that patients want a more organized approach to diet management in IBD care, both in terms of receiving clearer information and recommendations for handling one's own nutrition as well as in terms of practical assistance to help them succeed in their food-related decisions (Chuong et al., 2019; Czuber-Dochan et al., 2020; de Vries et al., 2019; Limdi et al., 2016; Palant et al., 2015).

The sense of losing control over one's own nutrition and quality of life, as well as the feeling of social isolation, tend to have a negative effect on a patient's psychological wellbeing. Many patients feel frustrated and annoyed by having to plan ahead due to their unique eating habits, which could lead to non-adherence and a worsening of symptoms (Czuber-Dochan et al., 2020; Palant et al., 2015).

Last but not least, it is significant to note that the vast majority of the studies included in our review were based on samples from the UK, European nations (Netherlands, France, Germany, and Poland), or nations with "western" cultures (USA, Canada, Australia). Furthermore, no research so far compared populations from other cultures, with the only partial exception of the work from Alexakis and colleagues (2015), which is focused on the particularities of cultural minorities (i.e.: black or south-asian) in the United Kingdom. The results of this study, however, show the relevance and importance of the cultural background in understanding the relationship between patients with IBD and nutrition. This is in line with the body of knowledge on food preferences and is particularly pertinent given that several research have demonstrated the influence of culture on people's dietary preferences, attitudes, and practices (Risso et al., 2017; Rodríguez-Arauz et al., 2016; Rozin, 2005). Future research should take into account the importance of cultural background and attempt to close the knowledge gap about how cultural variations may affect how food restrictions affect IBD patients.

This scoping review was a first attempt to synthesize the growing scientific discussion over how food consumption affects the quality of life of IBD patients. This study highlighted the gaps in the literature that still need to be filled.

2.5 Limits and future studies

This study has some limitations.

First and foremost, the screening procedure only took into account papers that could be retrieved by the authors and that were published in English, which may have resulted in the elimination of certain research that could be pertinent.

Additionally, the search technique only used a selection of scientific databases, which could have reduced the number of papers found and introduced bias. Finally, given the nature of the data, a meta-analysis was not possible, therefore this study serves mostly as a descriptive summary of the current state of the scientific knowledge on this matter, and as a guideline for future studies. This obviously restricts the range of inferences that could be made, and the data that were gathered may also be biased given their nature (being mostly obtained from patient viewpoints and interviews). There are also some drawbacks to the employed methodology, given the nature of scoping reviews: this study merely summarizes and discusses significant findings from quantitative (and qualitative) studies, thus giving a potentially biased assessment of the evidence. Readers need to be aware of this potential bias in the selection of the evidence. Scoping reviews, however, have their advantages, as they provide adaptable summaries of the "state of the art" in a field, have the ability to identify gaps in the body of knowledge on a particular subject, and are particularly suitable for addressing broad research topics like the one in this work (Arksey & O'Malley, 2005).

2.6 Conclusions

This scoping review highlighted some important gaps on the literature regarding food and IBD. In particular, the collected evidences show that the requested behavioral change regarding food is a potential cause of distress and lack of wellbeing for IBD patients. Literature indeed suggests that, even for healthy citizens, distress and poor mood might foster the use of food as a mood regulator (and, in particular, such "comfort food" that are often included in the lists of trigger

foods for IBD patients). Our hypothesis for future studies is that the distress caused by the lack of information, the uncertainty, and the impact that food restrictions exert of patients' well-being might indeed foster cheating and non-adherence to dietary recommendations, especially in those patients less adapted to the necessary changes in habits (i.e., less engaged). Figure 3 graphically shows how the hypothesized mechanism might work.

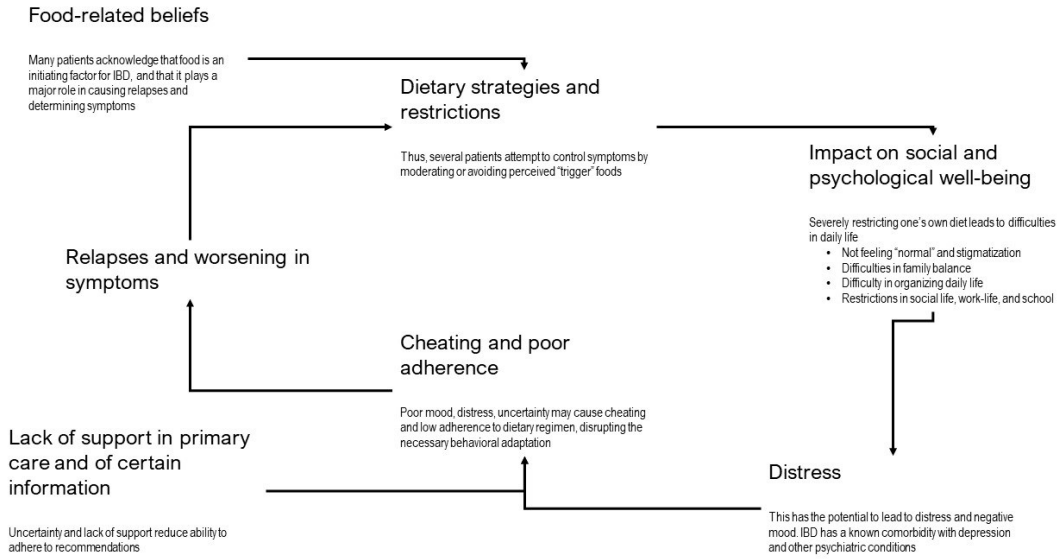


Figure 3: Hypothesis of how food restrictions might impact on cheating

A more comprehensive investigation should be conducted into the effects of erroneous beliefs, emotional discomfort, and social isolation on food choices and how this influences the management of symptoms. The findings of this study further emphasize the significance of directing interdisciplinary research projects in this field by bringing together psychological theories with those of nutrition and clinical practice.

In particular, it is clear that additional research is needed on the psychological effects of food on IBD patients' feeling of wellbeing, and how negative emotions are intertwined with IBD patients' food choices and restrictions.

Finally, research on pediatric patients (especially those in school years) is required since their social influence may be more significant from a developmental standpoint.

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3. Study 2: Food-related behavioral patterns in patients with Inflammatory Bowel Diseases: the role of Patient Health Engagement and Food Involvement

3.1 Study Introduction

The results from the scoping review described in Chapter 2 show that there are sound evidences that food is an important aspect in determining IBD patients' health and wellbeing (de Vries et al., 2019; Palamenghi et al., 2022; Zallot et al., 2013), even according to patients themselves, which sometimes report it to be more relevant than the pharmacological treatment in the management of symptoms (Limdi et al., 2016; Marsh et al., 2019). Thus, patients are often prompted to try to minimize the severity of their symptoms by avoiding particular "trigger" foods (meals that may cause or worsen symptoms), by choosing healthier foods, and generally by controlling their diet. As a result, one measure IBD patients typically employ to try to manage the activity of their disease is to avoid or reduce the consumption of particular foods, which ultimately results in renouncing to some foods they love and crave (Chuong et al., 2019; Palant et al., 2015); indeed, the foods that are more often reported as "triggers" are foods that might have a high desirability and palatability: spicy foods, fatty foods, alcoholic drinks, food with a high fiber content, milk and dairy products or lactose containing foods (Crooks et al., 2021; Marsh et al., 2019). Unfortunately, although generic guidelines and occurrences exist (Hou et al., 2014; Limdi, 2018), there is no "standard" diet that works for each patient, and often different patients report different foods as triggers (Zallot et al., 2013); due to this, patients may suffer from an overall lack of clear

information and unambiguous guidelines regarding the best diet for them (Limdi et al., 2016; Marsh et al., 2019; Palant et al., 2015). Additionally, the restrictions themselves exert a strong impact on their psycho-social wellbeing, causing distress and negative mood in patients. The resulting sense of frustration, the distress, and the feeling of "not being normal" may actually lead to non-adherence by cheating here and there with "forbidden" foods in an effort to feel more normal and to get back to their dietary habits (Chuong et al., 2019; Fletcher & Schneider, 2006; Palant et al., 2015; Schneider et al., 2009).

Our hypothesis is that this might be more evident in those patients that show a lower adaptation towards their health condition and the behavioral change that is requested to these patients (i.e.: less health engaged patients). Indeed, this necessity to pay attention to what, when, and how much they eat in order to avoid relapses is not easy to maintain, as it makes more difficult to manage food when eating outside home or during social gatherings, potentially making them feel less "normal" then others (Alexakis et al., 2015; Crooks et al., 2021; Czuber-Dochan et al., 2020; Palant et al., 2015; Zallot et al., 2013). In fact, research demonstrates that dietary limitations and the need to continually monitor what they eat have a significant influence on patients' quality of life and mood (Jordan et al., 2018): the concept of food-related quality of life (Hughes et al., 2016) operationalizes the psycho-social problems that IBD patients must deal with as a result of the limits on their diets. These problems range from the inability to enjoy food to the anguish brought on by having to pay closer attention to what they eat than normal (Guadagnoli et al., 2019; Hughes et al., 2016). Thus, it becomes crucial that these patients actively participate in self-management and are psychologically prepared

and capable of caring for themselves and their own diet, because they must define what foods they can and cannot eat, and actively shape their dietary habits in order to reduce the likelihood of relapses and to lessen the severity of symptoms. We have already discussed the definition and relevance of health engagement in chronic care in this manuscript (see section 1.5). For the purpose of this study, we will adopt the definition of patient engagement according described by the Patient Health Engagement model (PHE) developed by Graffigna and colleagues (Graffigna et al., 2015; Graffigna & Barello, 2018), already discussed in the aforementioned section of Chapter 1.

In addition to attention and engagement towards health, IBD patients need to focus their attention and motivation also towards food, as there is a relation between food and health in their lives. Thus, an additional psychological factor that might play a role in determining IBD patients' food choices is food involvement (Bell & Marshall, 2003), which has already been described in section 1.2. It's interesting to note that research has shown that people with a higher involvement towards food are more likely to prefer food that is seen as healthy and natural; they generally tend to have a healthier diet, even without special medical requirements (Marshall & Bell, 2004). But at least one study (Eertmans et al., 2005) on healthy individuals has also revealed that food involvement not only predicted a preference for healthier and more natural foods (in particular, for people with high food involvement, the consumption of milk is mediated by a preference for healthy and more natural foods), but also for foods with a higher sensory appeal (a mediator of the consume of spicy foods): however, in the case of IBD patients,

the inclination for appetizing meals may actually conflict with the requirement for a diet appropriate to their condition.

Our hypothesis is that Patient Health Engagement and Food Involvement are related constructs in this population and may characterize how IBD patients behave when it comes to food and reveal different driving factors. To the best of our knowledge, very few research have examined the psychological factors that underlie these behavioral patterns in IBD patients as well as the reasons behind their dietary decisions (Day et al., 2021; Palamenghi et al., 2022).

Given the impact that IBD patients' care experts have on healthcare systems and given the significance that food and nutrition have on IBD patients' wellbeing and symptoms, it is crucial to develop a method that enables the identification of the various drivers behind IBD patients' food choices, including why they might choose to eat foods that they may perceive as "triggers". In order to do this, the aim of this study is to explore the relationship between Patient Health Engagement and Food Involvement, and whether these psychological characteristics can be useful in identifying groups of IBD patients with different motives behind food choices, in particular regarding the choice to eat foods identified as trigger foods and to use food as a mean to regulate mood; additionally, given the important impact of food choices on IBD patients' quality of life and well-being, we aim at investigating whether the identified groups of patients have different levels of food-related quality of life, their emotional status, or other peculiar clinical characteristics.

3.1.1 Aims

More specifically, the aims of this study were two-fold:

- Describe the clinical characteristics and the alimentary habits of a large sample of Italian IBD patients
    - In particular, we were interested in studying the foods that in the Italian population are generally regarded as triggers, and the ones that are often cause of cheating, in order to identify the most problematic ones
    - Moreover, we also described the patient's levels of patient engagement and of food involvement
    - Finally, we also described their food-related quality of life, their overall mood, and how it relates to self-reported motives behind food choices
- Clustering patients according to their levels of patient engagement and food involvement, in the attempt to identify patterns of different motives behind food choices, with particular regard to those patients that use food as a mean to regulate mood and that report cheating with a larger number of foods. We decided to use patient engagement and food involvement as clustering variables as these represent, in our hypothesis, two fundamental aspects of the psychology of the consumer (and of the patient, in this case) that might help in understanding the dynamics behind healthy and unhealthy food choices, as already explained in the introduction of this work (namely, sections 1.2 and 1.5).

- Additionally, we intended to describe the identified clusters according to their food-related quality of life and mood, in order to explore whether patients with different ways of relating with health and food, and possibly with different motives behind food choices, also show an underlying different emotional status and a different food-related quality of life
- Finally, to characterize these groups according to their sociodemographic and clinical characteristics.

3.2 Methods

3.2.1 Sample and procedure

A purposive sample of Italian patients with inflammatory bowel disease was enrolled in a cross-sectional research. Participants were requested to complete a survey on the website Surveymonkey after giving their informed consent. Between April 3 and April 19, 2021, participants were enlisted by sending invitations through the e-mailing list of an Italian patient association (A.M.I.C.I. Onlus). The participants received no rewards or compensation. Participants needed to have received a diagnosis of IBD, and to be at least 18 years old to be eligible. The study has been approved by the CERPS, and was carried out in conformity with the Declaration of Helsinki and its subsequent revisions.

3.2.2 Measures

The online survey included both validated metrics and questions that were created for the specific purpose of this study. Measures can be divided into different sections; in particular:

Clustering variables

- Patient Health Engagement scale (PHE-s®): a measure of patient engagement developed by Graffigna and colleagues (2015). This scale has 5 items, each answered on a 7 points ordinal scale. The answering scale features, on the odd points, a label describing a series of states which a patient may recognize him-/herself; even points are considered intermediate points. Labels on the right (higher score) are associated with a higher level of health engagement. Respondents are asked to indicate the label or the intermediate point that better describes how they feel when they think about their own disease. Figure 4 shows the scale structure and the English items.
- Food Involvement Scale (FIS): validated by Bell & Marshall (2003), this scale is composed of 12 items, each answered on a 7-points Likert type scale. Higher scores correspond to a higher food involvement.

Sociodemographic and clinical variables

- Gender (M/F), age (in years), diagnosis (UC, CD, or IC), level of education (middle school or below, high school, university degree).
- presence of comorbidities, whether the patient has had relapses and/or hospitalizations in the last year, whether the patient is currently being cured with drugs for the IBD, and whether the patient underwent surgery due to IBD.
- Self-reported St. Mark's index: this is a succinct list of symptoms that IBD patients may have experienced. It is generally used in clinical settings to measure the severity of symptoms (Walmsley et al., 1998).

This index, which is typically completed by the doctor and necessitates a few physical tests, has also been effectively used in a self-reported fashion using a reduced form, which was used for our study (Maunder & Greenberg, 2004). Lower ratings (on a range between 0 and 13) denote symptoms that are less frequent and less severe.

Mood and quality of life

- Food-related quality of life (FR-QoL-29): the FR-QoL-29 (Hughes et al., 2016) is a questionnaire that assesses the quality of life of IBD patients regarding their relationship with food and how this affects their ability to go about their everyday lives and maintain their psychological health. It consists of 29 questions that must be answered on a 5-point Likert scale. Higher ratings suggest a worse food-related quality of life.
- A list of 10 possible emotional states (3 positive -namely happiness, hopefulness, satisfaction- and 7 negative -namely sadness, fear, anger, disgust, anxiety, distress, boredom) patients may have felt: patients were asked to rate between 0 (not at all) and 100 (absolutely) how much they felt that emotional state in the previous 24 hours.

Food choices and alimentary habits

- Food Choice Questionnaire (FCQ) in its 11-items formulation (Onwezen et al., 2019): this questionnaire explores people's motives behind food choices. Participants are asked to rate each "motive" on a 7 points Likert scale. Additionally, we added a single item asking how much it is important for them that a food "helps you manage your symptoms".

- A list of 30 items or food groups that are usually thought to be possibly responsible for an increase in IBD symptoms was compiled from the literature on IBD diet (Crooks et al., 2021; Marsh et al., 2019; Pituch-Zdanowska et al., 2019; Zallot et al., 2013), and patients were asked to identify which of these foods they perceived to be triggers. After that, participants were questioned about whether they had eaten any of the listed trigger foods in the preceding week and which ones. Patients were only asked about the foods that they indicated as "trigger". These were employed as a measure of compliance with the avoidance of foods that, in the patients' own opinions and experiences, would make their symptoms worse.

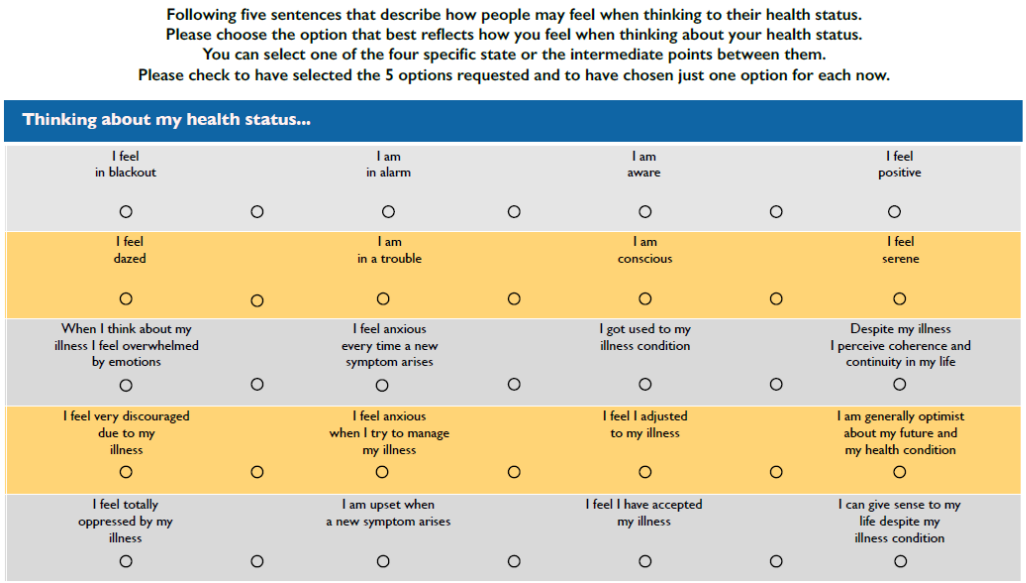

Figure 4: The PHE-s® scale structure and English items.

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3.2.3 Statistical analyses

Preliminary analyses: descriptive statistics and scale scoring

Descriptive statistics of the sample were computed to assess the composition of the sample and its characteristics, both sociodemographic, clinical, and psychological. Descriptive statistics were used to assess participants' alimentary habits and main motivators too. The results section describes the sample from these different points of view in separate paragraphs.

Moreover, in order to understand whether mood, food-related quality of life, and motives behind food choices are related, a Spearman's correlational analysis was carried out.

Finally, scales were scored according to literature. In particular:

- the FIS was scored by calculating the mean score to the answers to each item (after reversing the necessary answers);
- FR-QOL-29 followed the same procedure;
- The St. Mark's Index's answers were summed using as values those proposed by Walmsley et al. (1998), which resulted in an index with a range from 0 (no symptoms), to 13 (frequent and severe symptoms);
- Regarding PHE-s®, two different scorings were used for the purpose of this study. First, we employed the classic scoring procedure (Graffigna et al., 2015), which results in 4 ordinal scores which represent the 4 different levels of engagement as described by the PHE model (Graffigna & Barello, 2018). These scores were used for the descriptive part of the results. However, since our intention was also to use this Health

Engagement measure as a clustering variable in the subsequent analyses, we employed a diverse scoring procedure, which resulted in a normalized (0-100), continuous score. We re-coded the 7-points ordinal scales in 4 points (as for the normal scoring procedure), and then we checked uni-dimensionality and fit of each ordinal item at the construct of interest by running a Partial Credit Rasch model (PCM) (Andrich, 2014). PCM was selected in particular because the items (once recoded) provide four answer possibilities and display various usage patterns (namely, the distance between each step is different between the different items) (Bonanomi & Osmetti, 2012; Masters, 1982). A score for each participant was calculated by the PCM. Then, the Person Separation Index (PSI) was calculated to evaluate the PCM reliability. Values of PSI superior to 0.8 are generally considered acceptable (Prieto et al., 2003; Wright & Masters, 1982), and indicate a good reproducibility of the measured location of the persons. Additionally, to check whether the items fitted the expected model, fit mean square (MNSQ) statistics (Infit and Outfit) were computed: if the data fit the Rasch model, the fit statistics should be between 0.6 and 1.4 (Wright et al., 1994). The parameters of the Rasch model were estimated by the ML method (Andrich et al., 2000). Analyses of difficulty and step parameters were conducted to guarantee a sufficient ranking of the different categories of response and to respect the monotonic order.

Cluster analysis and subsequent investigation of the differences between clusters

In order to identify groups of patients with different levels of health engagement and involvement towards food, we used the PHE-s® and FIS scores as segmenting factors in a k-means cluster analysis to find participant groups that had comparable degrees of patient health engagement and food involvement. Before doing the k-means cluster analysis, scores were normalized in z-points due to the varied ranges of the scales. Moreover, participants having either PHE-s® or FIS z-points $>|3|$ were considered outliers and were eliminated from the sample. Since the k-means cluster analysis is an unsupervised statistical method, we conducted a series of tests beginning with 2 clusters and growing in numbers to identify the ideal number of clusters.

The parameters used to determine the ideal amount of clusters were:

1. Interpretability of the final clusters' averages and ANOVA's p-values;
2. Number of participants in each clusters (closer to homogeneity is better);
3. Pseudo-F values, calculated according to the procedure described by Calinski & Harabasz (1974): higher pseudo-F are an index of a better solution;
4. Finally, to address the stability of the identified best solution, the Rand Index (Rand, 1971) was calculated following the procedure described by Lattin et al. (2003); Rand Index is considered acceptable above the 0.70 threshold.

Finally, in order to address the leading question of whether patients with a different relationship with health and food show different motives behind food choices, different food-related behaviors, and also a different emotional status and quality of life a mix of χ^2 tests and one-way Welch's robust ANOVA were used to assess the differences across the identified clusters. In particular, differences investigated regarded:

- participants' sociodemographic and clinical descriptors;
- their food-related quality of life (Fr-QOL scale) and emotional states;
- their food choices (FCQ);
- the number of foods reported as potentially responsible for a worsening in their own IBD symptoms;
- the overall number of foods on which they reported having "cheated" in the last week;
- the specific food items on which cheating was reported more frequently (for this last step, each analysis was run on a sub-sample composed of only the participants which reported the food as a potential trigger food, as participants not deeming a certain food harmful could not be considered either "cheaters" or "non-cheaters" for that specific food item).

Significant ($p<.05$) χ^2 tests were followed by post-hoc analyses to assess which cells in the contingency table were significantly different from the others by inspecting adjusted standardized residuals, which can be considered significant when $>|2|$ (Agresti, 2013; Sharpe, 2015). Significant Welch's ANOVA were instead followed by Games-Howell post-hoc tests.

For those variables violating the assumption of normality in the ANOVA (skewness and/or kurtosis >|1|), to assess the robustness of the results the same model was run after conducting a logarithmic transformation and checking again for normality parameters. For the sake of interpretability, however, reported results are from the non-transformed variables unless otherwise stated.

Statistical software

The k-means cluster analysis and the following post-hoc analyses were conducted using the software IBM SPSS v27 (IBM SPSS Statistics for Windows, 2020). PCM was computed with SPSS extension STATS_EXRASCH v1.1.0 based on R package eRm and R version 3.6. The Person Separation Reliability was calculated directly on R v4.2 (R Core Team, 2022) with package eRm v1.0-2 (Mair et al., 2021; Mair & Hatzinger, 2007). Graphs were generated either by Microsoft Excel, or using JASP statistical software v0.16 (JASP Team, 2022), which was also used for descriptive statistics.

3.3 Results

3.3.1 Preliminary analyses

Sample: sociodemographic and clinical characteristics

Overall, 1113 participants responded to our invitation to take the survey. Of these, 211 were didn't provide complete answers, and were thus removed from the sample as we assumed they withdrew their consent to participate. 12 additional participants were also removed as they were considered outliers (see paragraph

"cluster analysis" in section 3.2.3): 890 patients were thus included in the final sample.

The average age of the participants was of 47 years old, with a standard deviation of 14, and a range going between 18 and 85 years old. On average, participants received their diagnosis 17 years before the survey, with a standard deviation of 11.5 and a range going between 0 (i.e.: less than a year) and 51 years before the survey was taken. The resulting sample was well distributed between females an males (about 60% and 40%, respectively), and also well distributed between Crohn's Disease and Colitis (both Ulcerative and Indeterminate), which resulted in exactly a 50-50 split of the sample.

Table 4 synthetizes the sociodemographic and clinical descriptors of the sample.

Table 4: Sociodemographic description of the sample of Study 2

VARIABLE	N	%
GENDER		
Male	355	39.9
Female	535	60.1
GEOGRAPHICAL AREA OF RESIDENCE		
North-West	260	29.2
North-East	268	30.1
Center	165	18.5
South & Islands	197	22.1
EDUCATION		
Middle school or lower	87	9.8
High school	422	47.4
University bachelor degree or higher	381	42.8
DIAGNOSIS		
Colitis (ulcerative or indeterminate)	445	50.0
Crohn's Disease	445	50.0

Scales scoring

The analysis of the difficulty and the step parameters from the PCM applied on the PHE-s® items showed that there was a sufficient ranking of the different categories of response and that the monotonic order was respected for each item of the scale. Additionally, both the infit and the outfit statistics could be considered acceptable, as they range were 0.75-0.82 and 0.70-0.82 respectively, and the PSI was more than adequate (0.871).

Scales were then scored and transformed in z-points, as described in the "Preliminary analyses: descriptive statistics and scale scoring" paragraph of section 3.2.3. Almost no variables showed an excessive (>|1|) skewness and kurtosis, with only a few -moderate- exceptions (see following paragraphs).

Descriptive statistics of the sample

St. Mark's Index and other clinical characteristics

Table 5 shows the distribution of the clinical characteristics in the sample.

Table 5: Clinical characteristics of the sample

VARIABLE	N	%
EXISTING COMORBIDITIES		
Yes	197	22.1
No	693	77.9
HOSPITALIZED IN THE LAST YEAR DUE TO IBD		
Yes	102	11.5
No	788	88.5
IBD RELAPSES IN THE LAST YEAR		
Yes	352	39.6
No	538	60.4
EVER DONE SURGERY FOR IBD		
Yes	336	37.8
No	554	62.2
CURRENTLY TAKING DRUGS/MEDICATIONS DUE TO IBD	784	88.1
Yes	106	11.9
No		

Regarding the St. Mark's Index, the mean value in the sample was 3.93 (SD=2.72), with a range going from 0 to 13 (thus all possible values). Kurtosis and skewness show no particular deviation from a normal distribution (-0.41 and 0.45, respectively).

Patient Health Engagement and Food Involvement

Table 6 shows descriptive statistics of the Patient Health Engagement scale (with continuous scoring, as described above) and of the Food Involvement Scale before being transformed in z-scores.

Table 6: Clustering variables descriptive statistics

VARIABLE	MIN. VALUE	MAX VALUE	MEAN	STD. DEV.	SKEWNESS	KURTOSIS
PHE-s®	-5.52	8.28	2.40	2.86	-0.148	-0.337
FIS	2.75	6.33	4.57	0.64	-0.76	-0.308

Both variables show an acceptably normal distribution (see Figure 5), with PHE-s distribution being slightly bimodal.

Regarding PHE-s®, as described in 3.2.3, also ordinal scores were computed, in order to evaluate the general distribution of the PHE-s® phases according to the deriving theoretical model (PHE model).

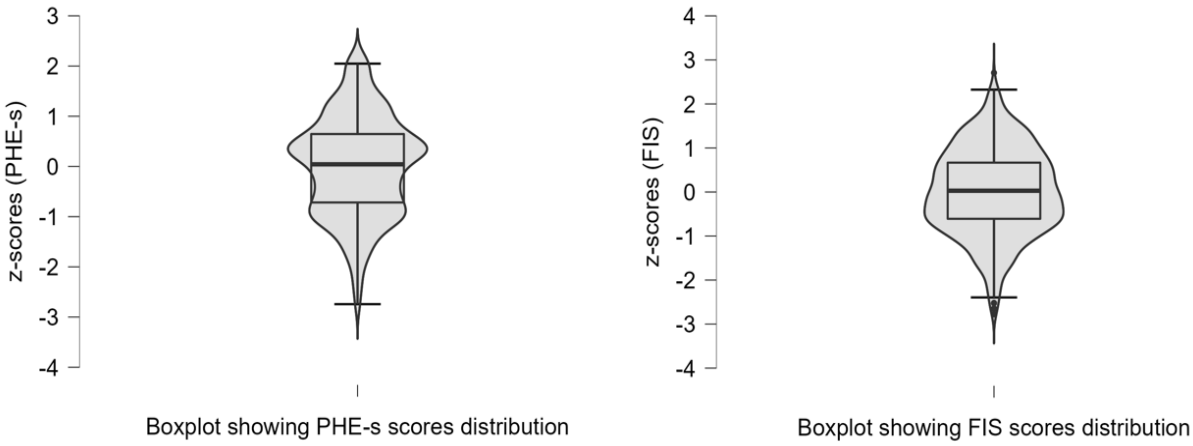

Figure 5: PHE-s® (left) and FIS (right) distributions

Results show that most of the patients included in our sample are in the Adhesion phase (n=429), thus with a moderate amount of Patient Health Engagement, or in the Arousal phase (n=298). The higher level of engagement ("Eudaimonic project") was only obtained by 131 patients, and only 32 were in the lowest possible level ("Blackout"). Figure 6 charts these data.

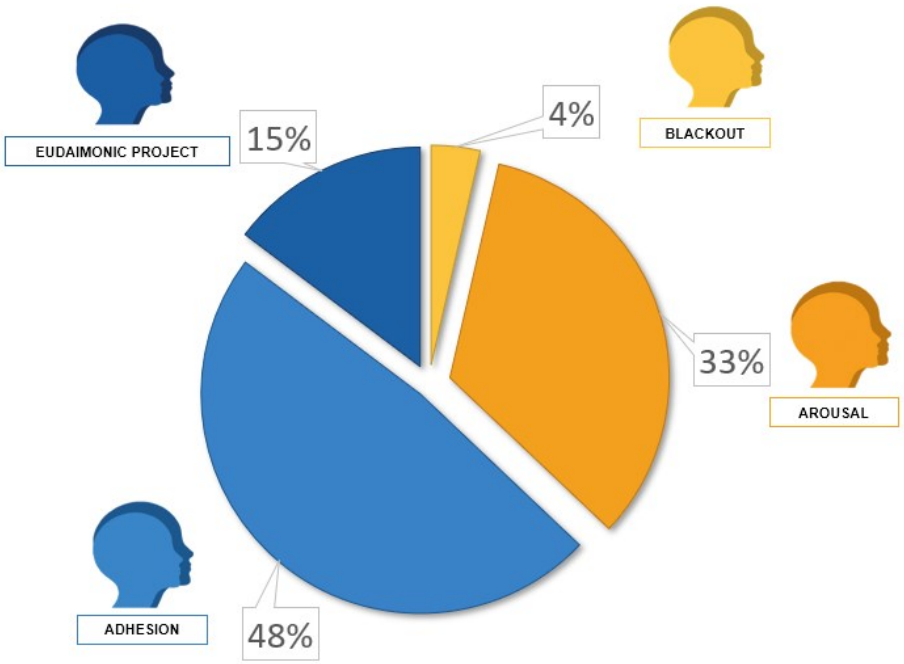

Figure 6: PHE-s® levels across the sample

Motives behind food choices

Table 7 shows the descriptive statistics of the 11 items of the Food Choice Questionnaire, plus the additional item developed *ad hoc* (see section 3.2.2). Once again, most item show an acceptably normal distribution.

Table 7: Descriptive statistics of the Food Choice Questionnaire (FCQ)

VARIABLE	MIN. VALUE	MAX. VALUE	MEAN	STD. DEV.	SKEW.	KURT.
It is important to me that the food I eat on a typical day...						
is healthy	1.00	7.00	5.96	1.02	-1.275	2.645
is a way of monitoring my mood (e.g. a good feeling or coping with stress')	1.00	7.00	5.03	1.50	-0.810	0.329
is convenient (in buying and preparing)	1.00	7.00	4.99	1.42	-0.835	0.568
provides me with pleasurable sensations (e.g. texture. appearance. smell and taste)	1.00	7.00	5.57	1.11	-1.105	1.987
Is natural	1.00	7.00	5.58	1.18	-0.878	1.023
Is affordable	1.00	7.00	4.93	1.39	-0.618	0.322
Helps me control my weight	1.00	7.00	4.75	1.66	-0.696	-0.154
Is familiar	1.00	7.00	4.47	1.41	-0.502	0.134
Is environmentally friendly	1.00	7.00	5.28	1.29	-0.755	0.626
Is animal friendly	1.00	7.00	5.18	1.42	-0.628	-0.027
Is fairly traded	1.00	7.00	4.47	1.14	-0.410	0.038
Helps me control my symptoms	1.00	7.00	6.18	0.96	-1.224	1.753

Percentages of patients that answered "a lot" (5, 6, or 7 on the Likert scale) were also calculated for each item of the FCQ. Overall speaking, "helps me control my symptoms" was responded by most patients (78%), as well as "it's healthy" (73%). Being pleasant (59%) and natural (58%) are also reported by the majority of the patients as being an important driver. Figure 7 shows the percentage of patients that reported each motivational driver as important.

Figure 7: Percentage of patients that indicated a motive as being important

Mood and quality of life

Table 8 reports all the descriptive statistics for the Food-related quality of life index (Fr-QOL) and for the ad-hoc questions surveying the emotional states. Once again, variables mostly show an adequate distribution.

Table 8: Descriptive statistics of mood and Food-related quality of life

VARIABLE	MIN. VALUE	MAX VALUE	MEAN	STD. DEV.	SKEW.	KURT.
Fr-QOL	1.00	4.97	3.10	0.85	-0.344	-0.443
Emotional state in the last 24 hours						
Happiness	0	100	58.66	26.37	-0.571	-0.331
Sadness	0	100	36.46	27.68	0.514	-0.694

Hopefulness	0	100	54.93	29.13	-0.235	-0.865
Fear	0	100	28.72	27.95	0.868	-0.239
Satisfaction	0	100	52.49	27.60	-0.180	-0.860
Anger	0	100	33.49	30.43	0.670	-0.776
Disgust	0	100	19.44	25.92	1.56	1.550
Anxiety	0	100	37.37	30.19	0.423	-0.977
Distress	0	100	46.65	31.28	0.090	-1.170
Boredom	0	100	29.65	29.30	0.778	-0.524

Interestingly, mood and food-related quality of life are correlated with some motives behind food choices, and with PHE. In particular, results of a series of Spearman's correlations show that the overall positive emotions have a strong, positive correlation with PHE-s® score (ρ=0.597; p<.001) and a strong, negative correlation with Fr-QoL score[1] (ρ=-0.400; p<.001). Additionally, positive emotions also have a negative correlation with the use of food as a mean to regulate mood (ρ=-0.131; p<.001) and, interestingly, with the management of symptoms (ρ=-0.119; p<.001); this is however coherent with the fact that there also is a negative correlation with the St. Mark's Index (ρ=-0.433; p<.001). Finally, positive emotions also show small correlations with the use of convenient, easy to prepare food (ρ=-0.096; p=.004), and attention to price (ρ=-0.072; p=.033).

On the other hand, negative emotions have a strong, negative correlation with PHE-s® score (ρ=-0.575; p<.001) and a strong, positive correlation with Fr-QoL (ρ=-0.464; p<.001). Coherently with the results reported for positive emotions,

[1] We remind the reader that Fr-QoL is reverse coded, thus higher scores correspond to a lower Food-related Quality of Life.

negative emotion score is positively correlated with the use of food as a mean to regulate mood (ρ=0.173; p<.001), and with the preference for convenient food (ρ=0.118; p<.001). Additionally, a positive correlation resulted statistically significant with the preference for familiar food (ρ=0.110; p=.001). Finally, a series of weak correlations with attention to price (ρ=0.074; p=.026), weight management (ρ=0.075; p=.025), and symptoms management (ρ=0.095; p=.004) resulted significant. Indeed, negative emotions are also correlated with the St. Mark's Index (ρ=0.366; p<.001). Interestingly, but coherently with the described construct, FIS does not appear to be correlated with the emotional status, but has a positive correlation with the Fr-QoL score (ρ=0.143; p<.001).

Finally, there seems to be also a strong and expected correlation between PHE-s® score and Fr-QoL score (ρ=-0.574; p<.001).

Trigger foods and cheating habits

Figure 8 shows the foods that are more often reported as potential triggers. The foods and meals that were more frequently indicated by participants as potential triggers were: spicy foods (75.7%), alcoholic drinks (65.4%), fried foods (63.8%), and fast foods (62.9%). The ones that were less frequently reported as triggers were white meat (2.9%), vegetable drinks (e.g. soy "milk", 8.9%), and seasoned cheese (10.7%). Only 8 patients (0.8%) reported not having any trigger food. Figure 8 also shows foods that are more frequently (calculated on the whole sample) reported as having being cheated with in the past week. The most problematic food are alcoholic drinks (25.2% of the whole sample), coffee (24%), chocolate (23.8%), and cured meat (23.7%). The least problematics were vegetable drinks (0.6%), white

meat (1.5%), fruit juice (2.3%), and tea (2.8%). 14.4% of the sample reported never cheating in the past week. Figure 9 instead shows the percentage of cheaters calculated on the number of persons that reported the food as a trigger (as opposed to the percentage calculated on the whole sample), to account for the fact that some foods were reported as triggers significantly more often. 59.5% (66/111) of the participants that reported cookies as triggers actually eat cookies in the past week; 55.2% (212/384) cheated with chocolate even though it's a trigger for them, 51.7% (214/414) with coffee, and 50% (13/26) with white meat. On the other hand, vegetable drinks (6.3%, 5/79), fast foods (7.7%, 43/560), fruit juice (10.5%, 20/191) and spicy foods (14.4%, 97/674) were the ones with the lowest percentage of patients that reported cheating if the food was identified as trigger. Figure 10 charts the food according to the number of participants that reported a certain food as a trigger, and the percentage of patients that admitted cheating on a food that they consider a trigger. The foods that are both most frequently reported as triggers and more frequently cheated on (i.e.: that fall above the median for both values), and can possibly be considered the most problematic, are: chocolate, coffee, cured meat, alcoholic drinks, fried foods, and -though marginally- raw vegetables.

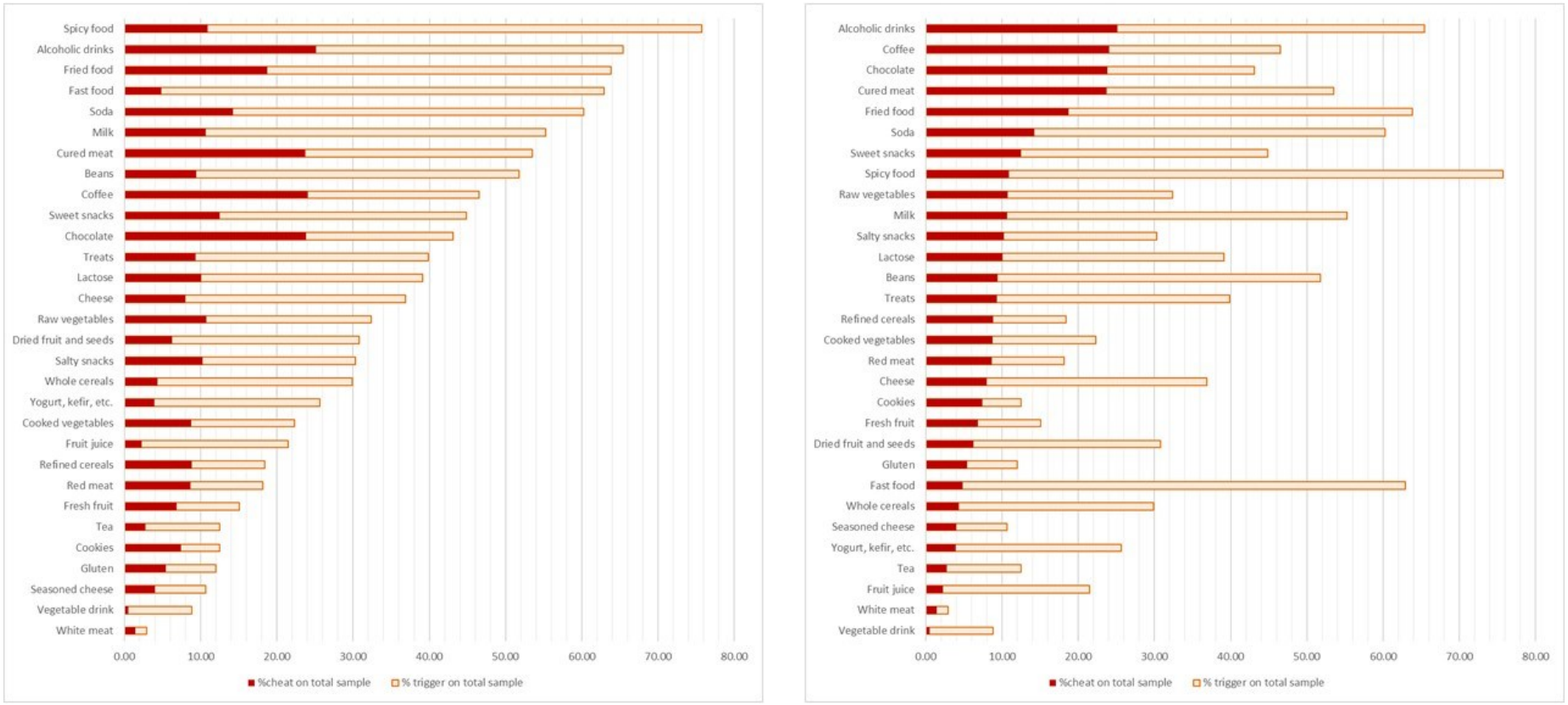

Figure 8: Foods more often reported as triggers and cheated with.

Chart on the left is ordered by reported triggers, chart on the right shows the same data but ordered by reported cheats. The percentages are calculated on the whole sample

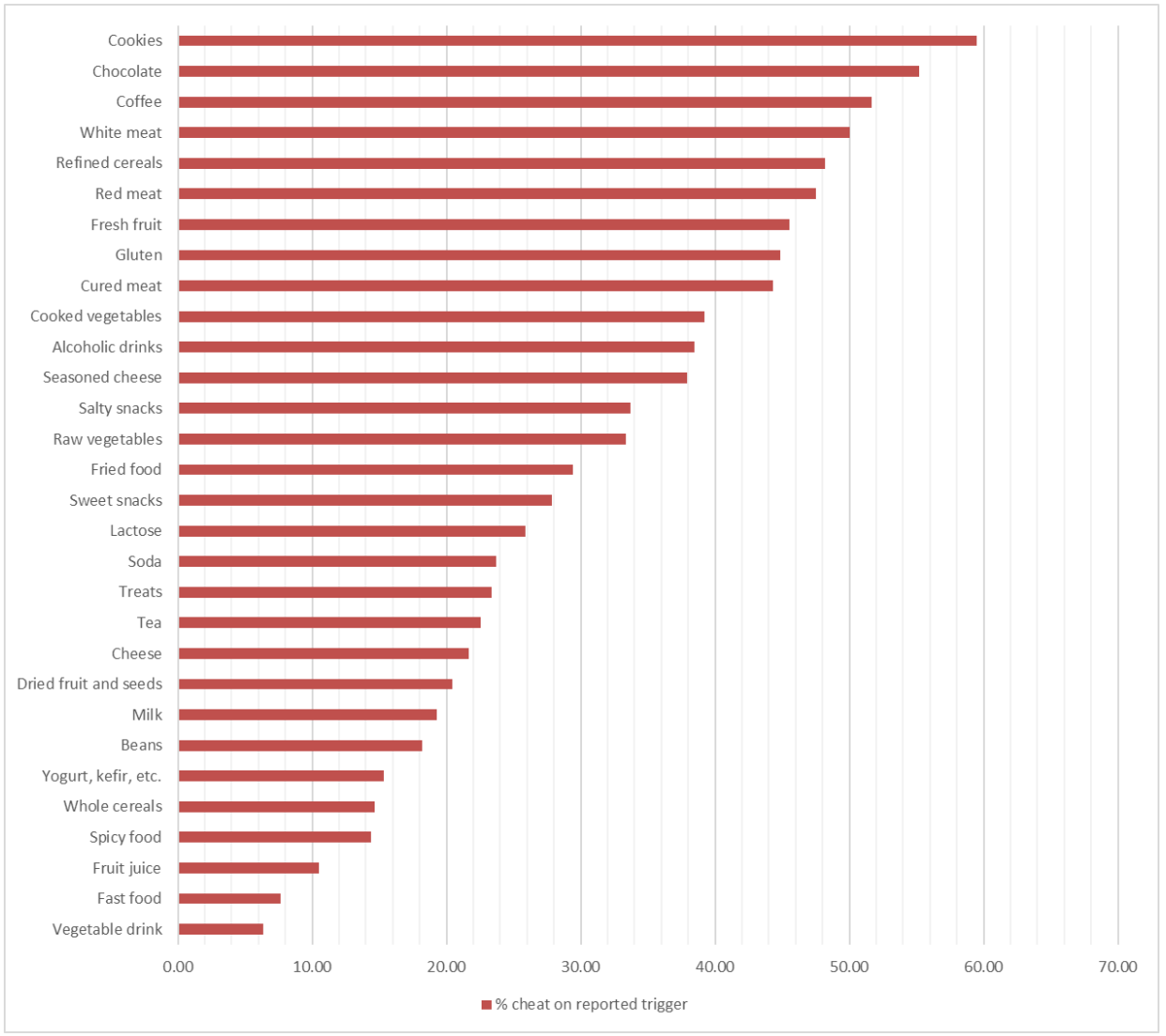

Figure 9: Percentage of cheaters for each food considered trigger

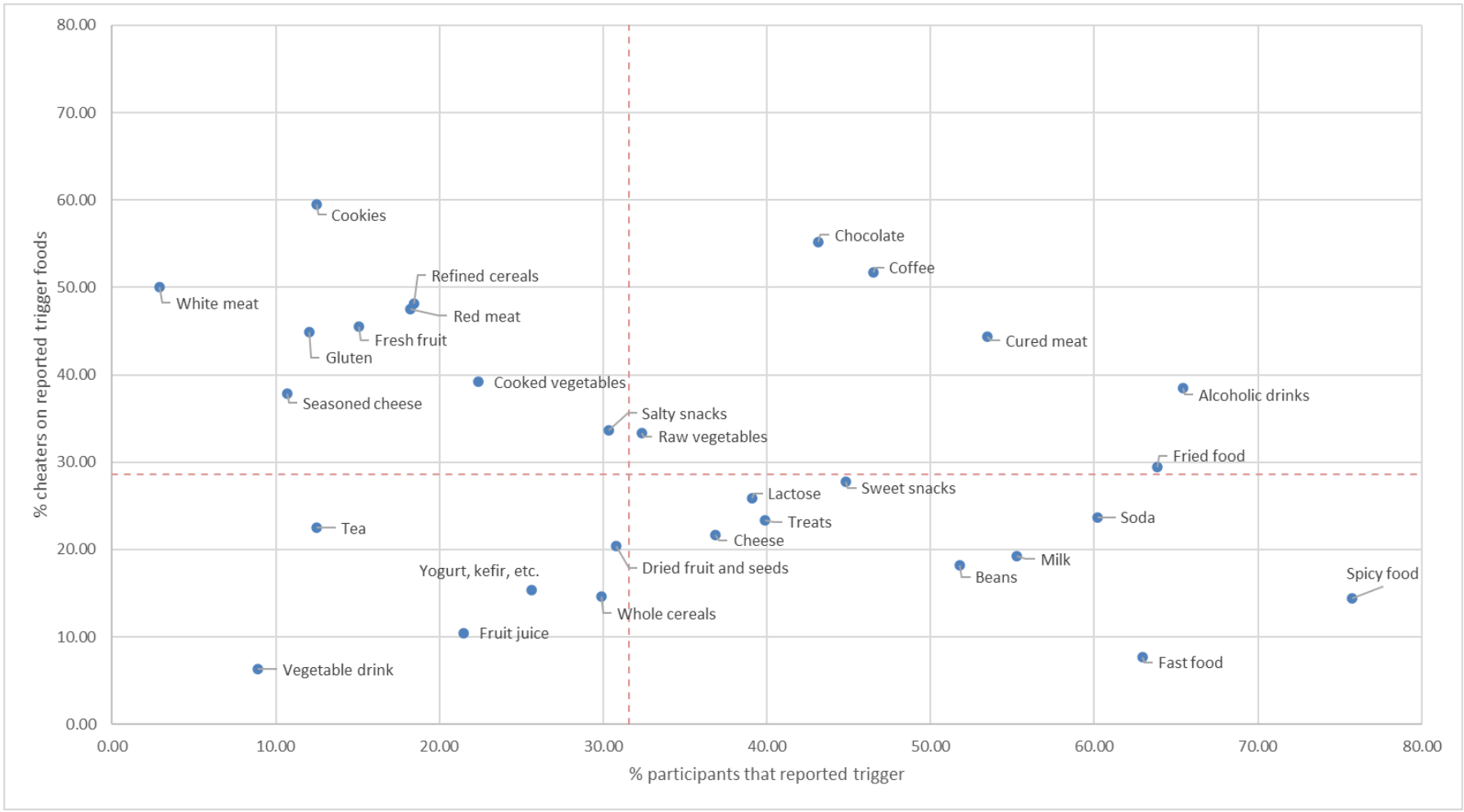

Figure 10: Foods charted.

The percentage of participants that reported a certain food as trigger is plotted against the percentage (calculated on the number of people that reported it as trigger) of cheaters on that food. The lines mark the medians on the axes.

3.3.2 Identifying and characterizing groups of patients

Cluster analysis

Different solutions (with 2, 3, 4 and 5 clusters) were tried, to create different groups of patients based on their PHE-s® and FIS scores. Among the solutions attempted, the one with 4 clusters resulted to be the most optimal, as the final clusters' means were the most interpretable, and had a reasonably homogeneous number of participants in each cluster (see Table 9). Pseudo-F was calculated for each solution, and the 4 cluster solution's Pseudo-F resulted to be the highest (473.055, 567.422, 610.208 and 577.528 for the 2, 3, 4 and 5 clusters' solutions respectively). Finally, the Rand Index for the 4 cluster solution was calculated (0.94) and resulted above the acceptability threshold.

Table 9: Distribution of participants among clusters and results of ANOVA

VARIABLE	CLUSTER				WELCH'S F	p	η^2
	1: Health Engaged (n=261)	2: Health Engaged & Food Involved (n=241)	3: Food Involved (n=187)	4: Non-engaged (n=201)			
PHE-S® CLUSTER MEAN	0.75[a]	0.71[a]	-0.90[b]	-0.94[b]	626.597	<.001	0.681
FIS CLUSTER MEAN	-0.80[c]	0.77[b]	0.92[a]	-0.73[c]	594.238	<.001	0.667

Mean scores with the same superscript letter do not differ significantly ($p > .05$) from each other (Games-Howell post hoc test). Superscript letters are ordered from the highest value to the lowest.

Investigating differences between clusters

Socio-demographic and clinical characteristics

Overall, results show that the resulting clusters are not strongly associated with sociodemographic or clinical characteristics. Anyway, χ^2 tests show that there are

different proportions of gender ($\chi^2_{(3,\ n=890)}$=39.529; p<.001), hospitalizations ($\chi^2_{(3,\ n=890)}$= 24.616; p<.001), and relapses in the last year ($\chi^2_{(3,\ n=890)}$= 92.681; p<.001) across the different clusters. Post-hoc inspection of residuals shows that cluster 1 (health engaged) shows a higher proportion of males (53.3%) and of participants which have not been hospitalized (95.4%) or didn't have relapses (78.2%) in the last year; cluster 2 (food involved & health engaged) has a higher proportion of female participants (66.8%) and of participants who didn't have had relapses in the last year (68.9%); cluster 3 (food involved) has a higher proportion of females (73.8%) and of participants which have had both relapses (61.5%) or hospitalizations (52.2%) in the last year; cluster 4 (non-engaged), finally, resulted being associated with relapses in the last year (52.2%). Indeed, cluster 4 was also associated with higher proportions of certain characteristics (being diagnosed colitis -56.2%- and never doing surgery in the past -69.2%); however, although the standardized residuals suggested this difference, the overall test resulted non-significant: while this means that this cluster, in the sample, shows these characteristics in a higher proportion than the other clusters, the non-significative χ^2 statistic means that the generalizability of this finding should be taken with caution. Table 10 reports the proportions of each sociodemographic and clinical characteristic in each cluster, the standardized residuals, and the according χ^2 statistic.

Table 10: Sociodemographic and clinical characteristics' distribution across clusters

VARIABLE	CLUSTER				χ^2	*p*
	1: health engaged	2: food involved & health engaged	3: food involved	4: non-engaged		
GENDER					39.529	<.001
Male	53.3% (5.2)	33.2% (-2.5)	26.2% (-4.3)	43.3% (1.1)		
Female	46.7% (-5.2)	66.8% (2.5)	73.8% (4.3)	56.7% (-1.1)		
EDUCATION					7.525	n.s.
Middle school	11.5% (1.1)	8.7% (-0.6)	5.9% (-2.0)	12.4% (1.4)		
High school	47.9% (0.2)	46.9% (-0.2)	46.5% (-0.3)	48.3% (0.3)		
University or higher	40.6% (-0.9)	44.4% (0.6)	47.6% (1.5)	39.3% (-1.1)		
DIAGNOSIS					4.418	n.s.
Crohn's disease	51.3% (0.5)	51.5% (0.5)	53.9% (0.9)	43.8% (-2.0)		
Colitis	48.7% (-0.5)	48.5% (-0.5)	47.1% (-0.9)	56.2% (2.0)		
COMORBIDITIES					0.132	n.s.
Yes	22.2% (0.0)	21.6% (-0.2)	23.0% (0.3)	21.9% (-0.1)		
No	77.8% (0.0)	78.4% (0.2)	77.0% (-0.3)	78.1% (0.1)		
HOSPITALIZATIONS					24.616	<.001
Yes	4.6% (-4.1)	10.8% (-0.4)	19.3% (3.8)	13.9% (1.2)		
No	95.4% (4.1)	89.2% (0.4)	80.7% (-3.8)	86.1% (-1.2)		
RELAPSES					92.681	<.001
Yes	21.8% (-7.0)	31.1% (-3.1)	61.5% (6.9)	52.2% (4.2)		
No	78.2% (7.0)	68.9% (3.1)	38.5% (-6.9)	47.8% (-4.2)		
SURGERY					5.814	n.s.
Yes	38.3% (0.2)	41.5% (1.4)	39.6% (0.6)	30.8% (-2.3)		
No	61.7% (-0.2)	58.5% (-1.4)	60.4% (-0.6)	69.2% (2.3)		
MEDICATIONS					3.328	n.s.
Yes	87.0% (-0.7)	86.3% (-1.0)	88.2% (0.1)	91.5% (1.7)		
No	13.0% (0.7)	13.7% (1.0)	11.8% (-0.1)	8.5% (-1.7)		

Values in cells represent the percentages of the relative characteristic in each cluster. Values in brackets represent standardized residuals, and cells highlighted in bold indicate where residuals show a significantly higher percentage relatively to sample at 5% significance (standardized residuals ≥2)

Welch's ANOVA showed a significant main effect of the clusters on age ($F_{3, 476.92}$=13.991; p<.001; η^2=0.045), although with a small effect size. Post-hoc Games-Howell tests revealed that overall participants in cluster 1 have a higher mean age

(M=51.07; SD=14.29) than all the other clusters (M=46.76, SD=12.54; M=42.8, SD=12.74; M=46.15, SD=13.89 for cluster 2, 3, and 4 respectively). Moreover, cluster 2 resulted having a higher mean age than cluster 3. Differences between cluster 2 and 4, and between cluster 3 and 4, resulted non statistically significant.

As for the St. Mark's index, a Welch's ANOVA showed that there is again a significant difference across clusters ($F_{3,\ 467,49}$=55.207; p>.001; η^2=0.165). Post-hoc results show that participants with a higher health engagement (clusters 1 & 2) have a significantly lower score (M=2.81, SD=2.32; M=3.19, SD=2.31 respectively for cluster 1 and cluster 2) than both cluster 3 and cluster 4 (M=5.52, SD=2.76; M=4.81, SD=2.66 respectively for cluster 3 and cluster 4). Differences between cluster 1 and cluster 2, and between cluster 3 and cluster 4, resulted non-significant. Figure 11 plots age's and St. Mark's index's distributions across the four identified clusters.

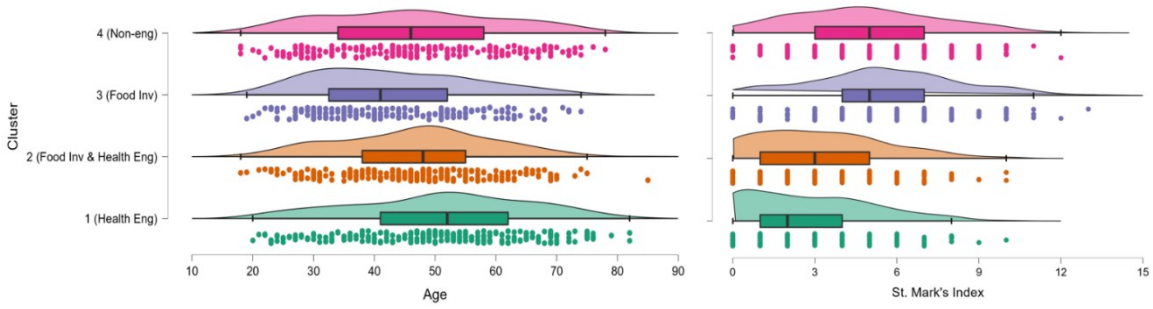

Figure 11: Raincloud plots show age (left) and St. Mark's Index (right) distributions across clusters

Food-related Quality of Life and emotional state

Table 11 reports the results of the Welch's ANOVA with clusters as factor and Fr-QoL and the emotional ratings as dependent variables.

Table 11: ANOVA results for Fr-QoL and emotional states

VARIABLE	CLUSTER NUMBER				F	*p*	η^2
	1: health engaged	2: food involved & health engaged	3: food involved	4: non-engaged			
FR-QOL	2.66 [c]	2.81[c]	3.68[a]	3.49[b]	104.161	<.001	0.257
HAPPINESS	66.55 [a]	70.54[a]	48.48[b]	43.65 [b]	66.491	<.001	0.186
SADNESS	28.24[b]	23.97 [b]	49.01[a]	50.44[a]	63.502	<.001	0.182
HOPEFULNESS	64.66 [a]	67.18[a]	42.09 [b]	39.56 [b]	67.085	<.001	0.185
FEAR	17.20 [b]	18.14 [b]	43.88 [a]	42.26 [a]	68.698	<.001	0.204
SATISFACTION	62.80 [a]	64.47[a]	41.80 [b]	34.70 [c]	82.559	<.001	0.217
ANGER	24.99 [b]	23.39 [b]	43.58 [a]	47.27[a]	38.467	<.001	0.122
DISGUST	14.87[b]	10.81 [b]	25.09 [a]	30.46 [a]	26.486	<.001	0.090
ANXIETY	25.68 [b]	25.18 [b]	52.84 [a]	52.75 [a]	71.408	<.001	0.202
DISTRESS	36.35 [b]	35.85 [b]	59.73 [a]	60.81 [a]	51.559	<.001	0.147
BOREDOM	25.59 [b]	22.00 [b]	34.49 [a]	39.57 [a]	16.720	<.001	0.056

Mean scores with the same superscript letter do not differ significantly (p >.05) from each other (Games-Howell post hoc test). Superscript letters are ordered from the higher value to the lower.

Results show a significant effect of being part of a cluster of Fr-QoL ($F_{(3, 482.698)}$=104.161; p<.001). In particular, post-hoc analyses show that cluster 3 (food involved, M=3.68, SD=0.69) has the higher score on the Fr-QoL scale (thus the lowest quality of life) when compared to the other clusters. Cluster 4 (non-engaged, M=3.49, SD=0.68) has the second-highest score, while cluster 1 (health engaged, M=2.66, SD=0.79) and cluster 2 (food involved & health engaged, M=2.81, SD=0.76) have the lowest score and no difference between them. Figure 12 shows the distribution of Fr-QoL scores across the four clusters.

Regarding emotions, results show that for each and all of them there was a significant main effect of cluster. For sake of brevity, we refer to Table 11 for the results. Overall, however, it can be observed that the two clusters with a high health engagement (1 & 2) show higher levels of positive emotional states (happiness, hopefulness, and satisfaction) when compared to clusters 3 & 4. The opposite happens for the seven negative emotional states.

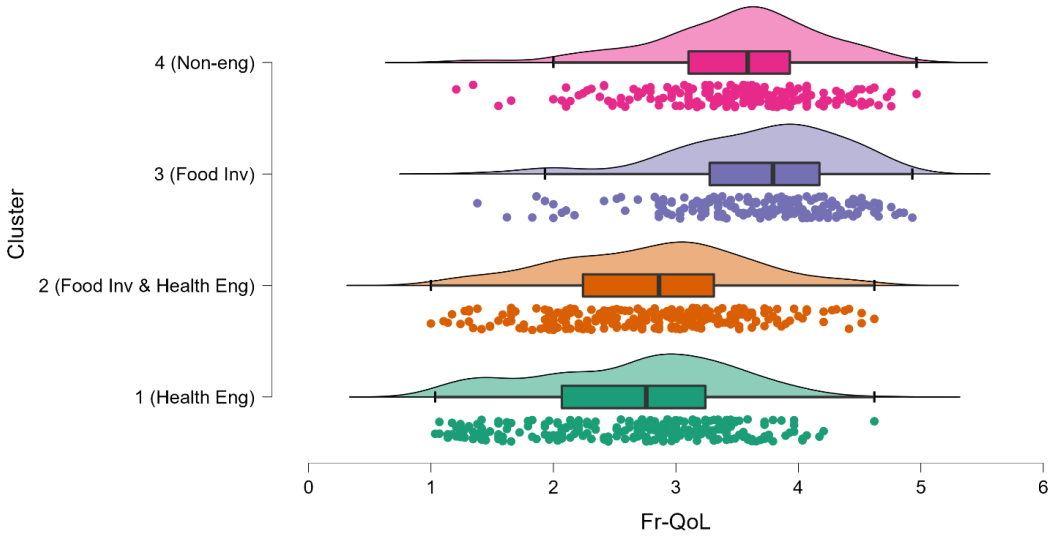

Figure 12: The raincloud plot shows the distribution of Fr-QOL scores across clusters (higher values correspond to lower QoL)

To test whether this was true, a final Welch's ANOVA on the averages of the scores of positive and negative emotional states was carried out with clusters as independent variables.

Results show that there is a significant main effect on the average of positive emotions' scores ($F_{(3,\ 475.085)}$=96.452; p<.001; η^2=0.246). Games-Howell post-hoc analyses show that there is not significant difference between clusters 1 & 2 (M=64.67, SD=22.25; M=67.40, SD=19.66; respectively) and between clusters 3 & 4 (M=44.12, SD=21.36; M=39.31, SD=22.39; respectively). However, as expected, both cluster 1 and cluster 2 scores resulted higher than both cluster 3 and cluster 4, with p<.001. Coherently, regarding negative emotions, results show a significant effect ($F_{(3,\ 460.556)}$=94.250; p<.001; η^2=0.255). Games-Howell post-hoc analyses show that there is not significant difference between clusters 1 & 2 (M=24.70, SD=15.86; M=22.76, SD=16.00; respectively) and between clusters 3 & 4 (M=44.10, SD=20.61; M=46.22, SD=21.15; respectively). However, as expected, both cluster

1 and cluster 2 scores resulted higher than both cluster 3 and cluster 4, with $p<.001$.

Figure 13 shows distributions of scores across clusters.

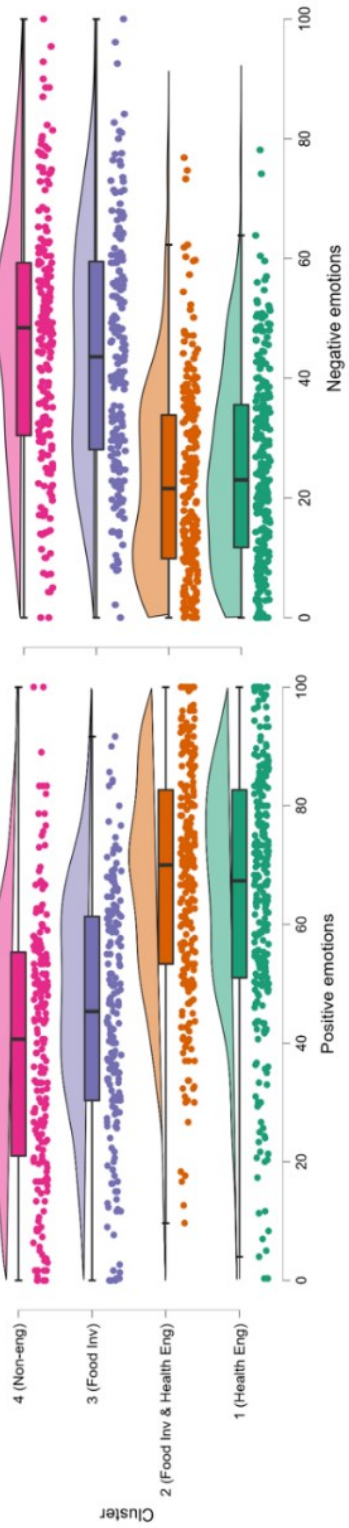

Figure 13: Distribution of positive and negative emotion scores across clusters

Food motives and cheating

Using the single items from the FCQ, results show that participants in different clusters have slightly different motives behind food choices.

For the sake of brevity, we refer to Table 12 for the summary of all the significant results. Anyway, the most prominent results show that, participants in cluster 2 and cluster 3 (thus the ones with a higher food involvement) are more concerned regarding the "healthiness" of their food when compared to participants in cluster 1 and 4. They also show a higher interest for food that provides pleasurable sensations, while participants in cluster 1 (health engaged) are the ones who show the least interest, along with cluster 4 (which is not significantly different from the others). Participants with a high Health Engagement (clusters 1 and 2) are less prone to use food as a mean to monitor mood when compared to clusters 3 and 4. Participants in cluster 3 (high food involvement) resulted being the most interested in using food as a mean to control symptoms, and participants in cluster 1 (high health engagement) the least. Finally, participants in cluster 3 reported being more interested in affordability when compared to participants in cluster 1; a marginal significance (p=.051) showed that participants in cluster 2 are the more interested in environmental friendliness, while participants in cluster 4 are the least interested.

Table 12: ANOVA results regarding food choices, number of foods deemed as being "trigger" foods, and number of foods on which cheating has been reported in the last week

VARIABLE	CLUSTER NUMBER				F	*p*	η^2
	1: health engaged	2: food involved & health engaged	3: food involved	4: non-engaged			
Is healthy	5.84[b]	6.16[a]	6.02 [a]	5.81[b]	6.749	<.001	0.020
Is a way of monitoring my mood (e.g. A good feeling or coping with stress')	4.64 [b]	4.98[b]	5.42[a]	5.24 [a]	12.476	<.001	0.038
Is convenient (in buying and preparing)	-	-	-	-	1.776	n.s.	-
Provides me with pleasurable sensations (e.g. Texture, appearance, smell and taste)	5.38[b]	5.70 [a]	5.73[a]	5.52 [a, b]	5.193	.002	0.017
Is natural	-	-	-	-	2.344	n.s.	-
Is affordable	4.75[b]	5.03 [a, b]	5.13[a]	4.87 [a, b]	3.668	.012	0.011
Helps me control my weight	-	-	-	-	0.636	n.s.	-
Is familiar	-	-	-	-	0.626	n.s.	-
Is environmentally friendly *	5.33 [a, b]	5.40[a]	5.28 [a, b]	5.05[b]	2.604	.051	0.010
Is animal friendly	-	-	-	-	1.013	n.s.	-
Is fairly traded	-	-	-	-	1.854	n.s.	-
Helps me control my symptoms	5.90[c]	6.18[b]	6.43[a]	6.31[a, b]	13.054	<.001	0.044
Number of foods reported as "trigger"	9.39[c]	9.82 [b, c]	12.55[a]	10.98[b]	14.714	<.001	0.052
Number of "cheats"	2.81[a, b]	2.76[b]	3.14[a, b]	3.40[a]	2.877	.036	0.010

*Mean scores with the same superscript letter do not differ significantly (p >.05) from each other (Games-Howell post hoc test). Superscript letters are ordered from the higher value to the lower. *p-value resulted slightly above the generally accepted threshold. However, since one of the post-hoc tests resulted significative, resulted were reported anyway. Particular caution should be exerted in generalizing these specific results.*

Furthermore, results show that -at least for some food items- there are differences among the percentages of "cheating" participants in different clusters. In particular, participants in cluster 1 seem to indulge more towards soda (32.3%) and alcoholic drinks (45.5%) when compared to the overall percentage in the sample (23.7% and 38.5%, respectively). Participants in cluster 2, instead, cheat more often with dried fruit (30.0%, compared to 20.4% in the sample) and less with treats (13.7%, compared to 23.4% in the overall sample) and with soda (12.5%, compared to 23.7% in the overall sample). Participants in cluster 3 didn't result cheating on any particular food, but resulted to be cheating less with fried foods (19.4%, compared to 29.4% in the overall sample) and with cooked vegetables (20.5%, compared to 33.3% in the overall sample). Non-engaged participants in cluster 4, finally, seem to be more indulgent towards sweet snacks, treats, and fried foods (42.2%, 32.4%, and 40.1% for sweet snacks, treats, and fried foods respectively, compared to 27.8%, 23.4%, and 29.4% in the overall sample), although cheating less with dried fruit (10.1% compared to 20.4% in the overall sample). Table 13 shows the results of the χ^2 analyses in this regard.

Finally, a Spearman's correlation was calculated to assess whether there is correlation between the experienced mood in the past 24 hours, and the preference of food as a mean to manage mood. Results show that, albeit small in effect size, there seems to be a correlation in the expected direction: positive emotions are negatively correlated (ρ=-0.131, p<.001), and negative emotions positively correlated (ρ=0.173, p<.001).

Table 13: percentage of participants that cheated with different foods in different clusters

FOOD PERCEIVED AS TRIGGER	CLUSTER				OVERALL PERCENTAGE	χ^2	*p*
	1: health engaged	2: food involved & health engaged	3: food involved	4: non-engaged			
Sweet snacks N=399	21.3% (-1.8)	*19.8% (-2.1)*	30.8% (0.8)	42.2% (3.3)	27.8%	14.519	.002
Treats (e.g. Candies, jellies...) N=355	28.0% (1.1)	*13.7% (-2.6)*	22.1% (-0.4)	32.4% (2.1)	23.4%	9.461	.024
Fried foods N=568	32.3% (0.9)	23.9% (-1.6)	*19.4% (-2.8)*	40.1% (3.3)	29.4%	16.838	.001
Soda N=536	32.3% (3.0)	*12.5% (-3.7)*	21.8% (-0.5)	28.0% (1.2)	23.7%	17.683	.001
Alcoholic drinks N=582	45.5% (2.1)	42.0% (1.0)	33.3% (-1.5)	31.8% (-1.8)	38.5%	8.133	.043
Dried fruit N=274	19.4% (-0.2)	30.0% (2.1)	23.1% (0.7)	*10.1% (-2.5)*	20.4%	8.248	.041
Vegetables (cooked) N=288	37.5% (0.9)	42.6% (1.9)	*20.5% (-2.8)*	34.3% (0.2)	33.3%	9.015	.029

Values in cells represent the percentages of patients which reported cheating with that food in each cluster. For each food item, only participants which reported it as potential trigger foods were included in the analyses, thus sample size is variable and indicated in brackets in the first column. Values in brackets represent standardized residuals, and cells highlighted in bold indicate where residuals show a significantly higher percentage relatively to sample at 5% significance (standardized residuals ≥2), while cells in italic highlight a standardized residual ≤2.
For brevity, only significant results are reported.

3.4 Discussion

The results of this study, although somehow explorative, are interesting. For the sake of clarity, we will discuss the results of different analyses or regarding different aspects of the study in separate subsections.

3.4.1 Sample characteristics and descriptive results

Sample characteristics

First and foremost, the recruited sample can be assumed to be adequately representative of the IBD population in Italy, at least for some characteristics: participants were recruited from all over the country, with a broad span of participants with different ages and clinical backgrounds, and with good proportions of genders and diagnoses. Indeed, the fact that in our sample there was a slightly higher percentage of female participants (6 out of 10) compared to males is coherent with the fact that IBDs seem to be somehow more prevalent among females (Betteridge et al., 2013). Literature suggests that there is a slightly higher prevalence of UC in the population when compared to CD (Betteridge et al., 2013; Shivashankar et al., 2017), while in our sample the number of CD and UC (plus a few cases of indeterminate colitis) where equal. However, even in the reported epidemiological studies the estimated prevalence of UC and CD are not particularly divergent (Shivashankar et al. for instance estimated 246.7 and 286.3 out of 100.000 people respectively for CD and UC); thus, although our sample may have slightly different proportions of CD and UC when compared to the population, this should have a minor impact on its representativeness. Overall, the sample resulted to be

acceptably representative of the population at least in regards to gender and clinical condition diagnosed.

Patient Health Engagement

This study proposed an alternative method for scoring the PHE-s®, which resulted in a quantitative measure that can be used in different, more ample analytical contexts compared to the classic ordinal scoring. The scoring procedure resulted robust, and all indices suggested that this different method of scoring is adequate. Indeed, this method of scoring was also used for the Public Health Engagement Scale for Emergency Settings (PHEs-E, see Graffigna et al., 2021), which is a "twin" measure with the same structure as the PHE-s®, intended to measure Public Health Engagement in an emergency setting such as the one caused by the COVID-19 pandemic.

Regarding the levels of Patient Health Engagement, it is interesting to notice that more than 1 patient out of 3 in our sample can be considered to have a low level of PHE (level Blackout or Arousal). Blackout patients, in particular, are probably underestimated: given the peculiarities of this phase of PHE (Graffigna & Barello, 2018) and the purposive nature of the sampling strategy employed, it is very likely that a higher proportion of patients in Blackout didn't respond to the survey, or where not reached by our invitation since they might not be in touch with a patients' association like AMICI Onlus. This high rate of patient that are not psychologically engaged in the self- management of their condition is alarming, and vouches for future interventions on this population. This is particularly important, given the relevance that self-care has in every chronic condition, and in

Inflammatory Bowel Diseases in particular, as the patient needs to find a balance in the diet to reduce the symptoms and maintain the pathology in a state of remission, and this is usually carried out with the assistance of a healthcare team: this might be difficult for a patient that has difficulty in accepting his/her own condition (i.e. a Blackout patient) or that has a low level of Engagement.

Additionally, as our results show, Patient Health Engagement is associated with a better food-related quality of life and better emotional state, once again vouching for the importance of this aspect in the care of chronic patients, including IBD patients.

Motives behind food choices

Regarding motives behind food choices, it is interesting to notice that the large majority of our sample (about ¾) indicated that its healthiness and its capacity in helping to control the symptoms are important factors when choosing food. Although the percentage might be somehow skewed by a social desirability bias (Grimm, 2010), it confirms what we previously found in literature: food is perceived, by IBD patients, as an important factor in health management and symptoms control (Halmos & Gibson, 2015; Palamenghi et al., 2022). It is however interesting that -along with pleasantness-, about half the sample reported that another important aspect when considering food choices is its naturalness. Although there as some evidence pointing out a possible relation between IBD and food additives (Raoul et al., 2022), this might also be due to the fact that consumers tend to perceive "natural" food (such as, for instance, organic food) as healthier (Harper & Makatouni, 2002; Kilic et al., 2021).

Moreover, in is interesting to notice that, from our results, there seems to be a relationship between the emotional state and the motives behind food choices. Generally speaking, our results show that patients that experience a more negative mood, in addition to having a lower quality of life related to food and a lower patient engagement, tend to use food as a mean to regulate mood, and to prefer food easy to prepare (such as, for instance, snacks or pre-cooked food). This is coherent with the literature suggesting that there is a relationship between poor mood and the consume of "comfort food" (AlAmmar et al., 2020; Leigh Gibson, 2006; van Strien et al., 2013), and between binge eating and poor mood in IBD patients (Day et al., 2021).

Interestingly, however, there is also a positive correlation between the negative emotional state and the use of food as a mean to control symptoms: this is probably due to the fact that patients with an overall lower mood tend also to have worse and more frequent symptoms, as measured by the St. Marks' Index. Thus, from the results, it seems that Patient Health Engagement, mood, food related quality of life, severity of symptoms, and the preference for comfort food are all somehow related. From the inspection of the correlations, patients with a higher Patient Health Engagement have a better emotional state, a better food-related quality of life, and need less food to control mood or symptoms. Patients with a lower Patient Health Engagement, show more severe symptoms, lower food-related quality of life, worse emotional state, and need food con regulate mood and symptoms. Interestingly, Food Involvement does not seem to be correlated with the emotional state.

The cluster analysis, which will be discussed in the following sections, will help to shed more light on how the levels of engagement towards health and involvement towards food characterize the patients regarding their motivations behind food choices and their emotional state.

Alimentary habits in a sample of Italian IBD patients

Results regarding the alimentary habits of the included participants and of the foods that they deem as potential triggers are overall coherent with the literature (Day et al., 2021; Palamenghi et al., 2022). Our data show that there are some foods that are more often reported as potential triggers, such as: alcoholics, spicy food, fried food, fast food, sodas, and milk. However, being often reported as a potential trigger does not imply that it is a food worth of particular attention. Indeed, our results also show that among the foods that are (overall on the whole sample) more frequently cheated with, there's coffee and chocolate, that are not however as often reported as triggers as milk.

Indeed, we think that particular caution should be given to those foods that are both frequently reported 1) as being triggers (thus, foods that are perceived to have the capacity to worsen the symptoms or cause relapses) 2) as being more frequently cheated with. These foods, in our sample, were in particular: coffee, chocolate, cured meat, and alcoholic drinks, but also fried food, soda, and snacks (both salty and sweet). As we can see, most of these foods have a high hedonic value (e.g. chocolate, soda, fried food), and could probably be considered "comfort foods", while other might also have a more important role in social gatherings (e.g.: alcoholics), or have a cultural value in Italy (such as coffee or cured meat). Interestingly, raw vegetables

could be also included in this list, although they are generally considered to be healthy. The fact that they are frequently "cheated with", however, could be due to the fact that the category in this case is particularly broad, and that not all raw vegetables have the same high-fiber content that makes them problematic for IBD patients.

3.4.2 Clusters of patients

Finally, the k-means cluster analysis found a 4-clusters solution with PHE-s® and FIS scores as clustering variable. The identified solution appeared stable, and interpretable. The four clusters identified were characterized by:

1. A cluster of patients with high health engagement, but low food involvement;
2. A cluster of patients with both a high health engagement, and a high food involvement,
3. A cluster of patients with low health engagement, and high food involvement;
4. A cluster of patients with both low health engagement, and low food involvement.

The four identified clusters show almost no differences regarding their socio-demographic characteristics (with the exception of the gender distribution).

Clusters and emotional state, food-related quality of life, and clinical status

On the other hand, some differences emerged from a clinical point of view: in particular, the groups with a higher level of Patient Health Engagement showed a

lower score on the self-reported St. Mark's index (i.e.: less frequent and serious symptoms). Although given the nature of this study it is impossible to establish any sort of cause-effect relationship based on these findings, this result is coherent with literature on Patient Health Engagement, as patients with a higher engagement generally show better outcomes, both clinical and psychological (Barello et al., 2020; Castellini et al., 2021; Chen et al., 2013). Indeed, the clusters characterized by a higher PHE-s® (clusters 1 & 2) also show a lower proportion of patients recently hospitalized and that had relapses. Additionally, the groups with a higher Patient Health Engagement showed a higher Food-related Quality of Life: this again might be due to the fact that patients with a higher PHE-s® score have a less severe symptomatology and thus, potentially, fewer problems with food; indeed, results also show that patients in cluster 1 and cluster 2 report a lower number of trigger foods. However, it is peculiar that the patients with the lowest Fr-QoL are the ones in the cluster 3 (i.e., with a low Patient Health Engagement and a high Food Involvement): this might be due to the fact that being highly involved towards food, patients in this group suffer more for the restrictions that they have to follow, and of the consequent cravings.

Finally, the two clusters with a high PHE-s® score showed also higher levels of positive emotions experienced, and lower levels of negative emotions, when compared with the clusters with a low PHE-s®, regardless of the Food Involvement.

Clusters and motivations behind food choices

The analyses carried out in order to study whether the clusters showed different motives behind food choices showed that, indeed, the clusters defined by PHE-s®

and FIS show peculiarities regarding their motivations. Our findings, in particular, indicate that the clusters with a high Food Involvement (2 & 3) are the ones that are more interested in "healthy" food, which is consistent with prior research on Food Involvement in healthy consumers (Eertmans et al., 2005; Marshall & Bell, 2004), regardless of their levels of PHE-s®. Additionally, again in line with the previously cited studies, the two clusters of IBD patients with have a high food involvement also exhibit a strong interest in foods that produce pleasurable feelings. For IBD patients, this may conflict with the requirement to avoid particular foods that can lead to relapses (foods with a high content of refined sugars, fatty foods, fried foods... namely: comfort foods!). Our results, however, show only minimal differences between the amount of foods that patients in various groups declared to have "cheated" with. This might also be due to the way cheating was measured, as we will discuss in the limitations section.

As previously mentioned, patients in clusters characterized with a high Food Involvement do seek pleasurable sensations in food. An interesting result that we observed was that patients in cluster 3 (high FIS, low PHE-s®) also reported a higher importance of the capacity of food to help in regulating mood and reducing distress, when compared to patients in cluster 2 (high FIS, high PHE-s®): this might suggest a maladaptive use of food of patients in cluster 3, possibly comfort and trigger foods, to reduce distress and help reducing negative feelings. Our claim is that patients with a high Food Involvement seek pleasurable food, but when supported by a high Patient Health Engagement, they show a better symptomatology and emotional state, thus they don't require the use of food as a mean to regulate mood. Instead, when patients with a high FIS score are not

supported by a positive adaptation towards their condition, and have a worse emotional state, they are more prone to abuse comfort food to regulate their mood.

This requires particular attention, as there is a well-known comorbidity between IBD and depression, anxiety, and other psychiatric conditions, especially during periods of relapse (Dubinsky et al., 2021; Filipovic & Filipovic, 2014; Mikocka-Walus et al., 2016) and there seems to be -at least in patients diagnosed with Crohn's Disease- a relationship between low mood, higher anxiety, and a worse control of food cravings, with resulting behaviors of binge eating (Wardle et al., 2018).

Consistently with this, also the group with both a low level of Patient Health Engagement and Food Involvement (cluster 4) reports a higher interest for the use of food as a mean to regulate mood, and a lower interest for its healthiness (although, inconsistently, they also report to choose food to "manage symptoms", which might be partially due to the social desirability bias, and/or to them not being aware of the potential conflict between these two aspects). However, given their lower Food Involvement, they report to be less interested in seeking pleasure through food.

It is also interesting to notice that the group with a high level of Patient Health Engagement but a low Food Involvement (cluster 1) doesn't seem to have a prevalent driver for food choices when compared with the other three clusters: this might be due to the fact that these patients have a better clinical status compared to the two groups with a low Patient Health Engagement (clusters 3 & 4), and are not as much involved in food as cluster 2.

Finally, it is interesting to notice that the four different groups also differ in regards to the trigger food on which patients reported "cheating": future studies should try to identify patterns in which trigger foods are more likely to be cheated on by IBD patients.

Table 14 summarizes the most salient characteristics of the participants included in each cluster

3.4.3 Practical implications and future studies

Although the results in this work need further corroboration, they suggest the existence of groups of patients with a different psychological approach to food choices and health management which may have interesting implications for the clinical practice. First and foremost, profiling patients with a brief and simple psychological questionnaire might be extremely useful, if this then allows to identify those patients that are, for instance, at higher risk of non-adherence. These patients could receive a different support and care. Moreover, if a psychological profiling of patients allowed to make robust inferences on their motivational style and reasons behind food choices, tailored approaches to education and support to adherence could be developed, making leverage on the specific motivational aspects that are more characteristics of a certain profile. Different, tailor-made approaches could be developed and co-designed keeping in mind the psychological and motivational profile of the different patients, thus fostering in a more patient-centered manner the engagement of these patients in self-management and adherence, obtaining a more positive and stable behavioral change.

For instance, the patients with low Health Engagement and high Food Involvement, may need an intervention aimed at: 1) improving their Health Engagement, thus sustaining a prospected behavioral change, and 2) helping them to find alternative strategies to the modulation of mood compared to the use of food. On the other hand, patients with a high Health Engagement and Food Involvement necessitate interventions more aimed at sustaining Health Engagement and a positive mindset rather than an educational one: they already have implemented, or are implementing, a positive behavioral change regarding food in their lives, and this change does not seem to be conflicting with their interest in food; however, given the difficulty that adhering to this change implies, healthcare professionals should keep monitoring the situation help the patient maintain this change.

Future studies, then, should strive to corroborate these exploratory results, possibly expanding them on the general population. Moreover, this study was carried in Italy on Italian participants: it is a rather well-known fact, also supported by scientific literature (Almerico, 2014; Castellini et al., 2020; Chiodo et al., 2022), that food culture in Italy has a peculiar meaning, so far that it is an important aspect of our ethnical identity (Laroche et al., 1998). Although we could not find any cross-cultural study on Food Involvement, it is reasonable to expect differences if not in the "quantity" of Involvement, at least in the meaning of what being Involved towards food means in Italy compared to other countries with different food cultures, and thus in how this construct might impact on food motivations and behaviors. Future studies should try to fill this gap, delving deeper in the cultural differences of what being "Involved" towards food means and how this

impacts on food choices, generalizing the results of this study or highlighting emerging cultural differences.

Table 14: Summary of the salient characteristics of participants in each cluster

VARIABLES	CLUSTER			
	1: Health Engaged	2: Health Engaged and Food Involved	3: Food Involved	4: Not engaged
Defining variables	High health engagement and low food involvement.	High health engagement and high food involvement.	Low health engagement and high food involvement.	Low health engagement and low food involvement.
Sociodemographic and clinical characteristics	Males, with no hospitalization or relapses in the last year. Higher average age. Fewer and/or less severe symptoms.	Females, with no relapses in the last year. Fewer and/or less severe symptoms.	Females, with relapses and/or hospitalizations in the last year. More frequent and/or more severe symptoms.	Diagnosis of colitis, with relapses in the last year and no surgical treatment in the past. More frequent and/or more severe symptoms.
Food-related quality of life and emotional state	High food-related quality of life and overall report a positive emotional state	High food-related quality of life and overall report a positive emotional state	Reported food-related quality of life is the lower among clusters, and overall reports a worse emotional state	Reported food-related quality of life is the low, and overall reports a worse emotional state
Food choice drivers	This group does not show a particular driver regarding food. In fact, compared to the other groups, these participants reported less interest towards healthiness, mood modulation, sensations, affordability and friendliness towards environment. Food is not deemed important for symptom management as well.	More interest towards food's healthiness and its pleasurable sensations. However, the seek for pleasure is not related to mood modulation, as they reported this driver as less important. Attention towards the environment is also present as well as symptom management (this last however not as high as for other clusters).	High interest for food's healthiness and its pleasurable sensations: in this case however pleasure is also related to mood modulation, as it is an important driver for this group. Affordability and symptom control are also important drivers as well.	This group shows a low interest for food's healthiness, and a high importance for its capability of modulating mood. Inconsistently, they also report a high importance for managing symptoms through food. Environmental friendliness is not important.
Food "cheating"	This groups report the least number of potentially problematic food, and an overall low number of cheats. They tend to cheat more with alcoholic drinks and sodas.	Relatively low number of potentially problematic food items, and lowest number of cheats. They tend to cheat more with dried fruits, and less with sodas, treats and sweet snacks.	Overall highest number of food items reported as potentially harmful. There is no food item which is more often cheated on, but they tend to cheat less on fried foods and cooked vegetables.	While they don't report the higher number of problematic food items, they report the highest number of food items cheated on. In particular, they tend to cheat more on sweet snacks, treats and fried food, while less on dried fruit.

3.4.4 Limitations

This study has some limitations.

First, the k-means cluster analysis is an explorative methodology: even though the solution with four clusters was interpretable and stable, with good parameters such as the Rand index, it does not mean that no other possible solutions with good characteristics exists.

A second limit of this study consists in the fact that all the involved measures, and in particular those measures regarding food behaviors, were self-reported from patients and not an actual measurement of behaviors. From a methodological point of view, this might have introduced some respondents' bias. In particular, regarding "cheating" behaviors, some information regarding their frequency and consequences were missing. Although this vouches for future studies, we believe that these results are a first important step towards the profiling of IBD patients' food related behaviors.

Finally, regarding sample, all the patients included in this study were volunteers recruited from a patients' association (AMICI Onlus): this might have introduced a bias in our sample, as patients that are subscribed to a patients' association might be more health literate, more careful in their health management, and overall more engaged. Future studies should try to address this limit, and to further validate and expand these findings in different cultural settings.

3.4.5 Conclusions

This study is, to the best of our knowledge, one of the first works that tries to delve deeper into IBD patient's motivations behind food-related behaviors, and how

these are intertwined with their psychological characteristics. Profiling IBD patients according to their engagement towards health and involvement towards food might allow clinicians to individuate those patients that are at a higher risk of maladaptive food-related behaviors, and to develop tailored communication strategies according to a patient's psychological characteristics and peculiarities, as well as the different motivational drivers behind those behaviors.

In particular, our results indicate that Patient Health Engagement is related to an overall better emotional state, a better adaptation to the required dietary changes (i.e.: a better food-related quality of life), and less severe symptoms. Generally speaking, possibly for this reason, the clusters of patients characterized by a high PHE-s® score reported that they tend to seek less frequently food for mood regulation. This seems to interact with FIS levels: overall, the groups of patients with a high FIS tend to seek pleasure through food, and this results in a higher difficulty in adapting to food restrictions (thus, a lower food-related quality of life), particularly for the group with a low PHE-s®. In fact, the cluster with high FIS and low PHE-s® is the group with the lowest quality of life related to food, and show a higher importance of food for mood regulation. Instead, the group which is supported by a higher level of Patient Health Engagement, and that also shows a better profile from the point of view of emotional state and of symptoms, tend to rely less on food to regulate mood, even though they still value seeking pleasurable sensations from food.

The relationship between Patient Health Engagement, Food Involvement, the emotional state, food choices, and the underlying motivations will need to be

addressed in future studies, that should also take into account the cultural component that might have an impact on how Food Involvement is intertwined with motivations and choices.

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4. Study 3: The modulating role of Health Engagement and Food Involvement in emotional responses to food stimuli

4.1 Study introduction

As we have already discussed, there's several evidences in literature pointing out that mood might have an effect on what we choose to eat, and in particular that a deflected mood might induce misbehaviors like binge eating, or the preference for comfort foods over healthier snacks (Christensen, 1993; Leigh Gibson, 2006).

The previous study, described in Chapter 3, tried to understand whether people with different involvement of people towards food, and engagement towards health, show different motivations behind food choices and different behaviors in regards to the compliance with dietary choices. In particular, the results showed that people with an increased engagement towards health reported a much lower interest in using food as a mean to regulate mood; this is coherent with the construct, as people with a higher Health Engagement generally show a better adaptation to the behavioral changes required by their own health condition and a good integration between their lifestyle and what the health condition dictates in terms of adherence and behaviors (Graffigna et al., 2017, 2020), in this case a healthier diet. Interestingly, these results show an interaction between Health Engagement and Food Involvement. Food Involvement is a stable characteristic of the individual that describes the (emotional, cognitive, and behavioral) commitment towards food in the 5 stages of its provisioning (Bell & Marshall, 2003), and is generally associated with the interest towards pleasurable food (Marshall & Bell, 2004): Food Involved consumers are often deemed as sensation seekers regarding food (Eertmans

et al., 2005; Foxall, 1993). In the results discussed in Chapter 3, we showed how pleasure is an important driver in food choices for people with a high Food Involvement: however, this is paired with mood regulation in people with low Health Engagement, and much less so in people with a high Health Engagement. Indeed, these results suggest that while food involved consumers seek pleasure via food, depending on their Health Engagement this may lead to a behavior of mood regulation via food (possibly using comfort food or unhealthy snacks), or to seeking pleasure without the need to regulate mood, possibly in a healthier manner.

Indeed, food and mood are two deeply related aspects of our lives: decades of clinical studies have shown that there is a connection between the emotional state of patients (and, overall, even of healthy consumers) and their food intake (Canetti et al., 2002), and even though positive mood seems to be somehow related to an increase in calorie intake (Evers et al., 2013), there is a rather known and established connection between degraded mood states -such as distress, boredom, and depression- and the consumption of the so-called "comfort food" (i.e.: food with a high content in fat and/or sugar that gives highly pleasurable sensations) (AlAmmar et al., 2020; Leigh Gibson, 2006; van Strien et al., 2013). According to the emotional eating theory, this happens because comfort food helps us to regulate negative states, although there seems to be noticeable (and not completely understood) differences in whether and how much people indulges in emotional eating (Macht & Simons, 2011). This, in conjunction with the fact that habitual consumers' behaviors are generally carried out without conscious control (Aarts & Dijksterhuis, 2000), may lead to the conclusion that -at least for certain consumers-

emotional control seems to play a very important role in determining their food choices, particularly their tendency to revert to comfort food and snacking.

Indeed, literature showed that the stimulus "food" generates emotions in consumers, and that these emotions have a strong importance in the decision-making process bound to food, given that they are highly predictive of their choices, preferences, and liking ratings (Dalenberg et al., 2014; Gutjar et al., 2014, 2015; Samant et al., 2017; Samant & Seo, 2019).

However, the characteristics that make it more likely for a person to indulge in this mechanism of emotional eating are not clear. The results from the study described in Chapter 3 suggest that Food Involvement and Health Engagement might play a role in determining how much a person indulges into emotional eating and in the choice of food to regulate mood, and whether it has some connection to the food-evoked emotions.

The overall aim of the current study would then be to see whether consumers, profiled according to their engagement towards health and food, pick different choices in regards to healthy and unhealthy snacks and drinks in a simulated behavioral task in a setting where mood has been artificially manipulated to elicitate negative feelings (which is known to incentive the preference for comfort food in some people, see for instance Werthmann et al., 2014). In addition to choices, food-evoked emotions will also be measured, since literature suggests (as already mentioned) a strong predictive value of liking and preference: in particular, our aim in this regard is to assess whether Food Involvement and Health Engagement are somehow related to the way food evokes emotions, and whether

this can be traced back to emotional eating in a situation with low mood. Since, as already mentioned, this process appears to be mostly unconscious, we will seek to employ a methodology that will measure food-evoked emotions via proxy, implicit, measurements. Indeed, there's several different ways to measure emotions in experimental settings (with physiological, behavioral, or cognitive measurements) on different layers (from unconscious levels of processing to higher levels) (Kaneko et al., 2018). Given the nature and the aims of our study, we intended to measure emotions on a more unconscious and basic level of processing, which vouches for implicit (physiological) rather than explicit (self-reported) measures. These measures also reduce the risk of social desirability bias in reporting preference for unhealthy snacks, as healthier behaviors might be seen as more desirable. In particular for this study, given the intention to use video stimuli, we planned to use -as described in the methodological section- pupil dilation (measured via eye-tracking technology) as a mean to measure emotional arousal (Bradley et al., 2008), paired with other proxy measures of autonomous activation such as Galvanic Skin Resistance (GSR) and Blood Volume Pulse (BVP) (Kaneko et al., 2018).

For this study, diversely from the study described in the previous chapter, we preferred to focus on healthy consumers rather than on IBD patients. The intention here is to transfer the findings of the previous study to a more general population, to assess whether the hypotheses hold up even on a healthy sample. The hypothesized mechanism by which Food Involvement promotes the preference for pleasurable food is known in the common consumer (Eertmans et al., 2005; Marshall & Bell, 2004), and the mechanisms that lead to emotional eating, and the role of food evoked emotions, are general cognitive processes. Generalizing the

results on a more ample population would help in understanding how consumers' preferences and choices are bound to their emotional state and reaction to food, and whether their psychological characteristics of engagement towards food and health plays a role in this dynamic. The results could then be replicated on clinical populations to assess eventual peculiarities.

4.1.1 Hypotheses

Overall, our claim is that participants with a higher attention towards health will be less aroused by "comfort" food in a situation where mood has been manipulated to be deflected, when compared to participants with a lower health engagement. This effect should be magnified by food involvement, with participants having a higher food involvement and lower health engagement being more activated by tasty, comfort food.

To summarize, the hypotheses tested in this study were:

1. There is a relationship between Food Involvement and the emotional response to food in a situation of manipulated low mood
    a. In particular, participants with a higher food involvement should show a stronger arousal (measured via PD, BVP, and GSR) to the food stimuli
    b. Patters should be recognizable, with more pleasurable comfort food evoking stronger arousal in participants with a higher Food Involvement
2. Health Engagement plays a role in how Food Involvement determines food-evoked arousal. In particular, based on the findings from Study 2

(see Chapter 3), we could expect participants with a higher Health Engagement to be less attracted and to show less arousal at the sight of comfort food, regardless of their Food Involvement.

3. There are differences, in groups with high/low Health Engagement and Food Involvement, in their food choices
    a. In particular, a higher health engagement leads to healthier food choices

Finally, we also sought to explore gender differences in regards to the distribution of Health Engagement and Food Involvement, and in food-evoked emotions.

4.2 Methods

4.2.1 Sample

Participants were recruited among the population with a purposive sampling. Flyers were attached on the campus were the data collection took place, and online advertising was shared on social media. Participants were promised a 5€ compensation if they passed the screening, and if they could fully participate to the study. Participants that were willing to take part to the study were asked to fill a brief screening survey. In particular, potential participants were asked to:

- Have a normal vision, or corrected-to-normal vision via single vision lenses (as these are less likely to cause issues with the eye tracker). Participants that reported the use of lenses were warned that it was possible that the instruments that were going to be used for the study could not be functioning due to the lenses, and that participation could

be interrupted due to technical issues. Participants that reported laser surgery or other interventions at the eyes, or that reported having clinical conditions at the eye, were thanked for their time and informed that they didn't pass the screening.

- Not have any clinical condition that requires the adherence to a specific alimentary regime, like diabetes, IBD, celiac disease, or other similar pathologies; moreover, participants with alimentary allergies were excluded from participation.

Participants were asked to refrain from eating and drinking anything in the 2 hours before the data collection took place.

4.2.2 Procedure

As described in section 4.2.1, participants were recruited via social networks, flyers, and word of mouth. Participants getting in touch with the experimenter via email, phone, or other means were then prompted to fill a screening survey, intended to evaluate inclusion criteria (see 4.2.1).

Eligible participants were then scheduled to visit the Engageminds HUB laboratory in Cremona, where the procedure was carried out. Participants were asked to refrain from eating or drinking two hours before the experiment, and to eat normally during the day. Participants were guided in the laboratory where the apparatus was set up: the room was prepared to reduce the amount of natural sunlight as much as possible by using covers and curtains at the windows and doors. Participants were asked to have a seat in front of the monitor and the eye-tracker (see 4.2.3 for details regarding the used apparatus). At this point, the

experimented explained the participants the procedure, and collected the informed consent on paper modules. At this point, the experimenter asked the participant to answer two questions regarding their hunger and thirst using pen and paper (see 4.2.3). Participants were then asked to find a comfortable position on the chair in front of the computer monitor and the eye-tracker, and were positioned at the correct distance (about 60cm). Participants were asked to put two fingers (index and middle finger of the non-dominant hand) in the apparatus that collected BVP and GSR measures. Artificial lights were turned off, and calibration procedure was then initiated: they were instructed to avoid excessive head and body movements, and to follow a white dot on the monitor with their eyes, being careful not to anticipate its movements. The dot followed a 5-points pattern (first center and then the four corners, starting from up-right to up-left, clockwise). A counter-proof of calibration was done on a 9-points screen. In case of pupils excessively difficult to track, high gain was activated, and 9-points calibration procedure was followed instead of the 5-points. In one case, monocular eye-tracking was carried out due to the difficulties being on a single eye (the left). If calibration was not possible to obtain in a reasonable amount of trials, participants were thanked for their time and debriefed.

Once calibration was successful, participants were shown a short video clip (about 2 minutes and 30 seconds) intended to manipulate their mood (see 4.2.3). Participants were then asked to answer, using pen and paper, two questions regarding their emotional state (see following section). If deemed necessary (e.g.: excessive head or body movements, loss of pupil track) a short calibration procedure was repeated.

Participants were then shown a series of stimuli on screen: 8 solid foods, and 4 drinks. Stimuli were shown in randomized groups (either foods or drinks before), and randomized inside groups. Participants were instructed to simply look at the pictures as if they had the actual food in front of them. Stimuli lasted 10 seconds each. Between each stimuli, a solid black cross was shown for 1.5sec in the middle of the screen on a white field: participants were instructed to stare at the cross. At the end of the group of stimuli, an on-screen text informed participants that they were about to see a picture with all the 8 foods/4 drinks on screen, and that their task was to take the mouse, and click on the food/drink that they would have eaten/drank in that moment above the others.

After both groups of variables were done and choices were made, participants were allowed to "relax" and move freely. They were then asked to fill a survey hosted on Qualtrics directly using the computer in front of them. After the survey was over, participants were thanked and debriefed.

4.2.3 Measures and materials

Implicit measures

The apparatus for the implicit measures consisted in:

- A dual-monitor setup. The first monitor (a 24 inches Thinkvision monitor) was used to show the stimuli to the participants, while the second monitor was turned away from the participants and used by the experimenter to check that data were being collected correctly. Mouse and keyboard were also present.

- A Gazepoint GP3 eye tracker set at 60Hz sampling frequency, with its software suite, was used to obtain eye-tracking data. In particular, given the purpose of this experiment, the main derived measure was pupil dilation, as it is a known proxy measure of emotional arousal (Bradley et al., 2008).
- The apparatus also included a bundle for the measurement of Blood Volume Pulse (BVP) and Galvanic Skin Response (GSR), which are again measures of emotional arousal towards a certain stimuli (Kaneko et al., 2018).

Stimuli

In order to induce a deflected mood, a short video was chosen, as literature suggests that this is one of the most effective procedure to induce mood in a laboratory setting, while still being acceptably non-invasive (Siedlecka & Denson, 2019; Westermann et al., 1996). In particular, the chosen videoclip is a 2:30 minutes clip from the movie Schindler's List, that -according to a recent study that validated the reactions to over 70 different clips (Schaefer et al., 2010)- is the most effective in generating negative emotions in the "sadness" category. The movie clip was presented dubbed in Italian language with no subtitles.

Food stimuli were picked from the Foodcast Research Image Database (FRIDa), a collection of food picture used for research in neuroscience and validated on an Italian population to be non-ambiguous (Foroni et al., 2013). Stimuli were chosen on the premises of the results from the previous study (see, in particular, the paragraph "trigger foods and cheating habits" under section 3.3.3) and in agreement

with a dietician (Dr. Camilla Fioroni, which I would like to acknowledge for the contribution). In particular, the following stimuli were chosen: an industrial ice-cream, bread slices, a banana, a dessert, parmesan cheese, a cookie, chips, and an apple (see Figure 14).

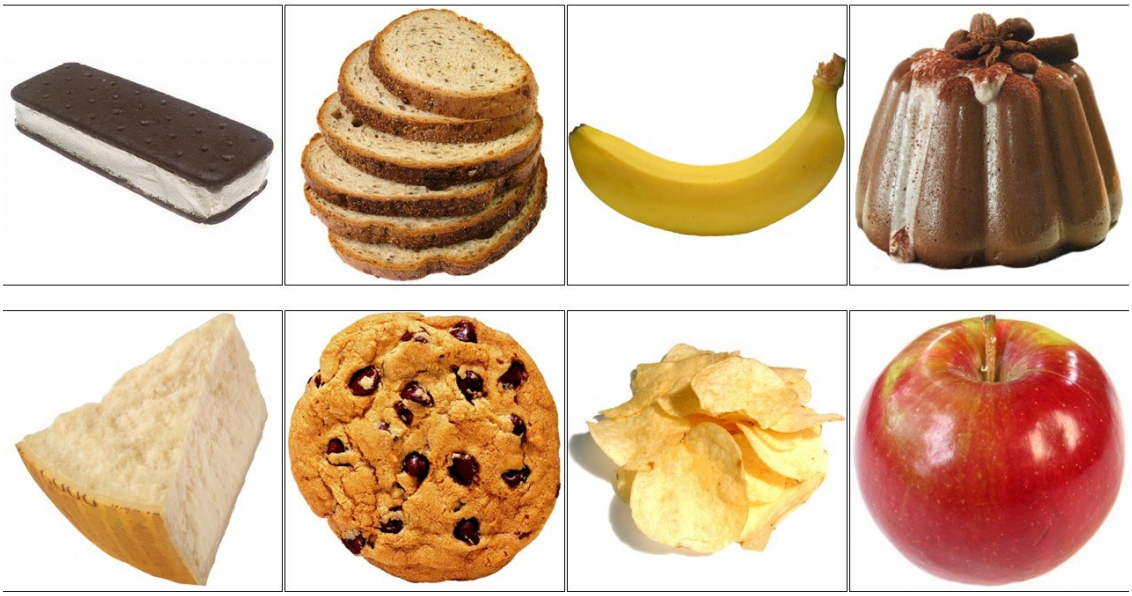

Figure 14: food stimuli used

In addition to food stimuli, we also wanted to deploy drinks, to have a second set of different stimuli. Since on the FRIDa database no drinks were available, with the help of an expert graphic designer (Marina Barello, which I sincerely acknowledge for the contribution) designed four stimuli depicting different drinks: a soda, a cup of tea, a fruit juice, and a beer (see Figure 15).

Figure 15: drink stimuli

Explicit measures

After the vision of the videoclip, participants were asked to rate their emotional status using a mannequin scale from happy (1) to sad (5): participants which reported being happy (answer 1 or 2) were later removed from the data pool.

Finally, participants were asked to answer a computer-based survey comprising the following questionnaires:

- As a measure for Food Involvement, we included the Food Involvement Scale (FIS; Bell & Marshall, 2003)
- As a general mean to measure Health Engagement (HE), six items were selected, which were used on a healthy population in a previous publication (Graffigna et al., 2020). The items consists in a series of statement answered on a 7-points Likert-type scale of agreement (low score, low health engagement)
- As a second mean to measure Health Engagement specifically towards healthy eating, we included the Health and Taste Attitude scale (HTAS) by Roininen et al. (2001) in the Italian validation (Saba et al., 2019). To avoid excessive strain on the participants, and to reduce the collection

or little-to-not relevant data, only the subscale regarding the General Health Interest (GHI) was included. This second measure was included to have a more food-related nuance of Health Engagement, while the six items from Graffigna et al. are more general.

Finally, participants were asked their gender and age.

4.2.4 Statistical analyses

Data curation, descriptive statistics and scales scoring

Each participant's eye-tracking data were screened and cleaned according to the valid/invalid flag values generated by the Gazepoint Analysis software (invalid data points were due to blinks or other artefacts in the data individuated by the software). Then, for each stimuli, the mean pupil dilation in millimeters (automatically corrected by a scale factor relative to the head distance estimated by the software) was calculated by averaging all the data points of left and right eye. The same procedure was then followed for Heart Rate (HR, measured in beats per minute or bpm) and Galvanic Skin Response (GSR, measured in μS). A baseline was also established by averaging the measurements collected during the non-food stimuli (i.e.: fixation crosses between each stimuli). Finally, additional aggregated measures were calculated, namely separate PD, HR and GSR averages for Health and Unhealthy foods and drinks.

Scales were scored by averaging participants' responses to the items after reversing the scores whenever necessary. Cronbach's α index and McDonald's ω index (estimated with CFA method) of reliability were also calculated for each

scale. Groups were also identified for each constructs according to score above or below the average.

Relationships between socio-demographical (i.e.: age and gender) and psychological characteristics were also explored, as well as the distribution of psychologically defined groups across genders.

Relating psychological constructs with physiological and behavioral data

Spearman's non-parametric correlations between HE, GHI, FIS scores and physiological measures of PD, HR, and GSR were computed for each food stimuli, for the composite scores described above, and for the baseline measure.

Significant correlations were then explored in different subgroups (defined based on gender or split by high/low scores on the psychological scales).

Finally, contingency tables were computed to check whether participants with high/low levels of GHI, HE, and FIS had a preference for certain foods/drinks and for health/unhealthy foods/drinks overall. Pearson's Chi-squared were computed on these tables to check for associations between variables.

4.3 Results

4.3.1 Sample, data curation, scales scoring and descriptive statistics

Sample description

Overall, 29 participants were recruited for our study. Two participants were excluded from the study before any data were collected, as the eye-tracker was unable to track their pupil and collect any useful data. Another participant was excluded after data collection, as the vision of the videoclip didn't elicit any

negative mood, as explained in section 4.2.3 ("Explicit measures"). For one participant left-eye data were impossible to retrieve, as the software did not recognize the pupil and calibration was not successful due to unknown reasons. However, given that right-eye data were reliable, and single-eye calibration stable and successful, the software was set up in order to track only the right pupil and the participant's data were collected and included in the analyses. For two participants HR data were not recorded, possibly due to hardware failure after calibration and during recording; eye-tracking data were retained anyway. Of these two participants, one was also missing GSR data for the same reason.

11 participants out of 26 (42%) were males, and the remaining 15 females (58%). Participants' average age was 38 years old (median 34.5, standard deviation 13.6), the younger being 21 years old and the older being 61 years old.

Most participants (21/26, 81%) reported that at the time of the study they were not following any specific diet. The remaining participants were either following diets prescribed by a dietician or nutritionist for sporting reasons, or (1 participant) reported being vegan for personal reasons.

Scales scoring, descriptive statistics and correlations between constructs

Regarding the FIS scale, results show an almost acceptable reliability (α=0.65; ω=0.59). Mean score among participants was 4.98 (median 4.78; SD=0.78; kurtosis -0.21; skewness 0.24). The items concerning Health Engagement showed a good reliability (α=0.80; ω=0.82). Mean score among participants was 4.72 (median 4.88; SD=0.94; kurtosis -0.76; skewness 0.27). As for the subscale of the HTAS, the GHI

showed a good reliability (α=0.76; ω=0.78). GHI score had an average of 4.62 in the sample, with a SD=0.96, median=4.86, skewness=-0.72 and kurtosis=-0.30.

FIS score does not correlate with either HE nor GHI measures (ρ=0.037, p=0.859; ρ=0.106, p=0.605; respectively), while HE and GHI show a moderate, positive correlation (ρ=0.499, p=0.009).

4.3.2 Relationship between sociodemographic characteristics and psychological measures

Overall, there seems to be no relevant relationship, in our sample, between the measured psychological characteristics of interest and gender.

In particular, results from a series of t-test showed no significant difference between males and females for FIS score ($t_{(24)}$=-0.329; p=0.745), HE score ($t_{(24)}$=-0.124; p=0.902), and GHI score ($t_{(24)}$=-1.233; p=0.230). The results from these t-tests should be, however, regarded with caution given the lack of statistical power due to the sample size. A series of Pearson's χ^2 was thus run between gender and groups of participants split based on FIS, HE, and GHI scores (as described in the methods section). Results seem to confirm that there is no association between gender and these constructs ($\chi^2_{(df=1,\ n=26)}$=0.158, p=0.691; $\chi^2_{(df=1,\ n=26)}$=0.004, p=0.951; $\chi^2_{(df=1,\ n=26)}$=0.540, p=0.462; respectively for gender*FIS, gender*HE, and gender*GHI).

Finally, a visual inspection of the distribution of scores across genders was also carried out, which overall seems to confirm a rather similar distribution across the two genders, with possibly females scores being somewhat leptokurtic (see Figure 16).

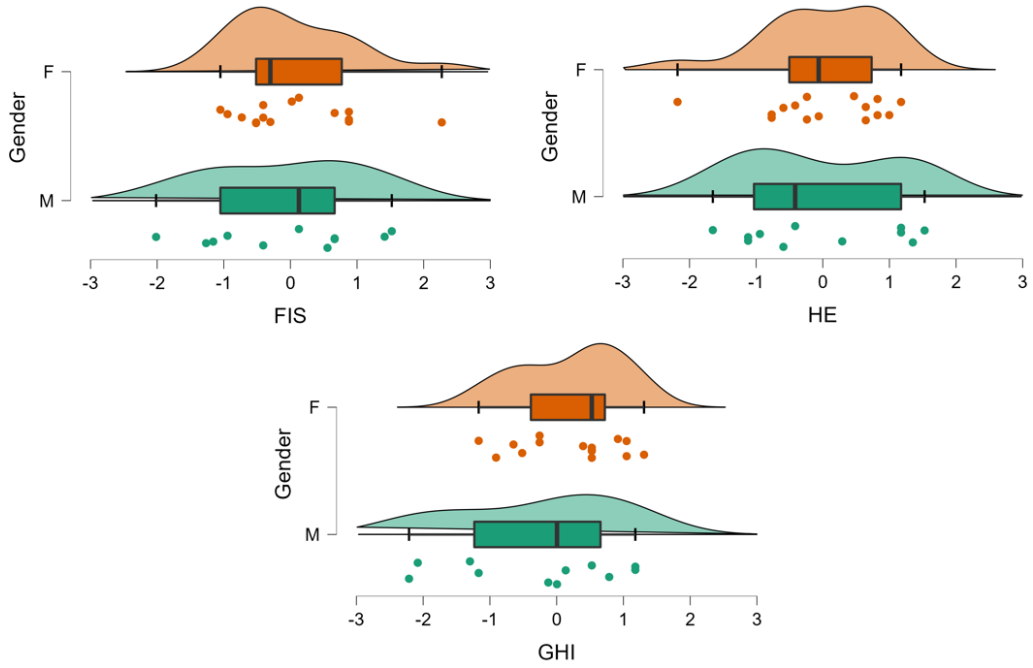

Figure 16: GIS, HE, and GHI scores distributions across genders

Both HE and GHI measures don't seem to be correlated with age in the sample (ρ=0.085, p=0.679; ρ=-0.022, p=0.916; respectively); on the other hand FIS shows a moderate and marginally significant negative non-parametric correlation with age (ρ=-0.401, p=0.042).

4.3.3 Relating psychological characteristics to implicit measures

Interestingly, results from Spearman's correlations showed that the construct of Food Involvement has a correlation with the pupil diameter at the sight of the food and drink stimuli. The correlation happens with all the food and drink stimuli, save for Banana, Apple, and Beer. Some correlation were only marginally significant, possibly due to sample size. Table 15 reports the results of the correlations.

Table 15: results from non-parametric correlations between Pupil Dilation and Food Involvement for each stimuli

STIMULI	SPEARMAN'S ρ	*p*
Banana	0.311	0.122
Bread	0.488	0.011
Apple	0.364	0.680
Parmesan cheese	0.411	0.037
Tea	0.389	0.049
Juice	0.472	0.015
Pudding	0.479	0.013
Chips	0.400	0.043
Cookies	0.468	0.016
Ice-cream	0.428	0.029
Soft drink	0.464	0.017
Beer	0.351	0.078
Healthy Food	0.436	0.026
Healthy Drinks	0.428	0.029
Unhealthy Food	0.438	0.025
Unhealthy Drinks	0.428	0.029

Contrary to expectations, however, even the baseline measure seems to correlate with FIS score (ρ=0.435; p=.026).

No correlation was shown with GSR data, and only for some items there was a correlation between FIS and HR, namely: ice-cream (ρ=-0.407; p=.048) and Apple (ρ=0.466; p=.022).

For HE, no significative correlations overall appeared to be significant, and even for GHI no recognizable pattern nor significance was revealed by correlational analyses with the reaction to stimuli.

Exploring FIS correlations among different groups

Interestingly, results show that the positive correlation between FIS and PD described above appears to be significant only for the group with a low HE, and not for the group with a high HE (with a few exceptions, see Table 16).

Table 16: correlations between PD and FIS for the different stimuli in the low and high HE groups

	Low HE *(n=14)*		High HE *(n=12)*	
STIMULI	SPEARMAN'S ρ	*p*-value	SPEARMAN'S ρ	*p*-value
Banana	0.487	0.077	0.151	0.640
Bread	0.710	0.004	0.161	0.616
Apple	0.410	0.145	-0.046	0.888
Parmesan cheese	0.664	0.010	0.021	0.948
Tea	0.664	0.010	-0.063	0.845
Juice	0.679	0.008	0.186	0.563
Pudding	0.604	0.022	-0.306	0.360
Chips	0.485	0.079	0.253	0.428
Cookies	0.569	0.034	0.316	0.317
Ice-cream	0.635	0.015	0.084	0.795
Soft drink	0.584	0.028	0.179	0.578
Beer	0.509	0.063	0.214	0.504
Healthy Food	0.560	0.037	0.189	0.555

Healthy Drinks	0.679	0.008	0.088	0.786
Unhealthy Food	0.593	0.025	0.130	0.688
Unhealthy Drinks	0.598	0.024	0.105	0.745

The same effect happens if we observe correlations in two subsamples split by GHI, although with a few more exceptions (see Table 17).

Table 17: correlations between PD and FIS for the different stimuli in the low and high GHI groups

	Low GHI *(n=12)*		High GHI *(n=14)*	
STIMULI	SPEARMAN'S ρ	*p*-value	SPEARMAN'S ρ	*p*-value
Banana	0.387	0.214	0.220	0.449
Bread	0.791	0.002	0.205	0.482
Apple	0.527	0.078	0.200	0.492
Parmesan cheese	0.668	0.018	0.112	0.702
Tea	0.640	0.025	0.084	0.776
Juice	0.696	0.012	0.256	0.378
Pudding	0.032	0.926	-0.501	0.081
Chips	0.527	0.078	0.220	0.449
Cookies	0.643	0.024	0.359	0.207
Ice-cream	0.692	0.013	0.130	0.658
Soft drink	0.622	0.031	0.324	0.259
Beer	0.475	0.119	0.233	0.422

Healthy Food	0.591	0.043	0.253	0.382
Healthy Drinks	0.696	0.012	0.178	0.542
Unhealthy Food	0.583	0.046	0.240	0.408
Unhealthy Drinks	0.601	0.039	0.260	0.370

Food choices

Almost every food in the list was chosen at least once, with the only exception of pudding which was never selected. The most often chosen foods were Banana (n=6) and Apple (n=6). Table 18 reports participants' food choices, and Table 19 drink choices.

Table 18: food choices

FOOD STIMULI	N	%
Banana	6	23.1
Chips	2	7.7
Cookie	3	11.5
Ice-cream	4	15.4
Apple	6	23.1
Parmesan cheese	4	15.4
Bread	1	3.8
Pudding	0	0.0

Table 19: drink choices

DRINK STIMULI	N	%
Beer	8	30.8
Soft drink	6	23.1
Juice	10	38.5
Tea	2	7.7

Overall, 17 participants out of 26 chose a healthy snack over a comfort food, and 12 out of 26 a healthy drink alternative.

Results from Pearson's chi-squared analysis applied to contingency tables show that there is no significant difference in the proportions of males and females that chose healthier snacks and drinks ($\chi^2_{(df=1,\ n=26)}=0.454$, $p=0.500$; $\chi^2_{(df=1,\ n=26)}=2.735$, $p=0.098$; respectively).

However, there seems to be some differences in how participants in different groups, defined by levels of FIS, GHI, and HE chose healthy snacks and drinks.

Regarding participants with different HE levels, results show no difference in the choices of healthy food ($\chi^2_{(df=1,\ n=26)}=0.910$, $p=0.340$), but an almost significant difference in drink choices ($\chi^2_{(df=1,\ n=26)}=3.773$, $p=0.052$; $\varphi=0.381$). In particular, results showed that a higher proportion of people with a high HE (8/12, 67%) picked a healthier choices compared to the subsample with a lower HE (4/14, 29%). A similar effect could be observed when splitting the sample by GHI: results from Pearson's chi-squared analysis ($\chi^2_{(df=1,\ n=26)}=5.539$, $p=0.019$; $\varphi=0.462$) show that a larger proportion of participants in the high GHI group (12/14, 86%) preferred healthier snacks compared to participants in the low GHI group (5/12, 42%); the

same effect could not be observed, however, for drinks, as the results yielded a non-significant p-value ($\chi^2_{(df=1,\ n=26)}=0.181$, $p=0.671$). Finally, results showed no significant differences in this regard between the high FIS and low FIS groups ($\chi^2_{(df=1,\ n=26)}=0.170$, $p=0.680$; $\chi^2_{(df=1,\ n=26)}=2.476$, $p=0.116$; respectively for foods and drinks), although for drinks a pattern could be observed where participants in the high-FIS group tended to prefer unhealthy drink choices (9/13, 69%) over the low-FIS group (5/13, 38%).

4.4 Discussion

The main result of this study is that, in a condition where participants' mood has been modulated with a vision of a negative-mood inducing videoclip (Schaefer et al., 2010), the amount of Food Involvement of the participants in our sample correlates with the dilation of the pupil at the sight of food and drink stimuli.

As already mentioned in the introduction, Pupil Dilation (PD) is often used as a proxy measure of emotional arousal and activation of the autonomous nervous system (Bradley et al., 2008) in response to a stimuli: generally, under an even cognitive load, a more dilated pupil is revealing of an underlying interest towards the presented stimuli (Aboyoun & Dabbs, 1998; Hess & Polt, 1960). This is coherent with our initial hypotheses and with the current definition of Food Involvement (Bell & Marshall, 2003). It does not strike as surprising, thus, that participants with a higher involvement towards food seem to show a higher arousal at the sight of a food or drink stimuli. However, this correlation does seem to exist for every stimuli presented, irrespective of its hedonistic value and regardless of its characteristics, while we could expect differences, given that literature and our

previous study suggests that a high food involvement is related to the preference of certain characteristics of foods such as palatability (Eertmans et al., 2005; Marshall & Bell, 2004).

While it is indeed possible that this might be due to a different functioning of this construct in our sample, the surprising result that this correlation happens for the baseline measurement too (measurement based on the average pupil size during the 1.5" fixation cross between the food/drink stimuli) leads to the more likely conclusion that stimuli were presented too close one to another to allow a proper "wash out" of the pupil dilation between one stimuli and the other. This might also explain why the same correlation was not found (with a few exceptions) for GSR and HR data, which have a lower response profile compared to PD and a higher latency. Regardless, this possible methodological flaw does not affect the result that participants with a higher FIS showed a stronger emotional response to food overall. Given that FIS scores was not found significantly different between genders, nor correlated with age, and that it has a solid theoretical explanation, it seems unlikely that this effect might be due to a spurious relationship.

Interestingly, further analyses showed that this correlation appears only in the subgroups with a lower attention towards health, be it measured in terms of general Health Engagement or in terms of General Health Interest (towards food, given how the construct is operationalized). Again this result does not seem to be due to underlying gender or age effects.

Our explanation for this effect is that, participants with a lower Health Engagement have a stronger emotional activation in reaction to food when they

also have a high Food Involvement. This intuition is coherent with what previously seen in Study 2: results from Study 2 indeed seem to suggest that people with a high food involvement and a low health engagement are more attracted to pleasant food and more prone to an emotional use of food (as a mean to regulate mood): the results from this study, thus, might confirm an underlying mechanism behind this behavior. What we claim, and the future -more controlled- studies should try to assess, is that (at least in a condition where mood has been manipulated to be more negative), consumers with a high attraction towards food and a low attention towards health show a stronger arousal at the sight of food. This, however, does not seem to happen for participants with a high engagement towards health, which seems to act as a modulating factor, reducing food-involved consumers arousal at the sight of food (potentially switching consumers' rational focus towards the healthiness of the food or the calorie intake). Indeed, results from the analyses of participants' food choices suggest that the groups with a higher HE and GHI tend to prefer healthier foods and drinks, although results on this regard are not completely clear and definite.

This study was built on results from a study that was focused on a sample of IBD patients, which were considered an interesting case study for their peculiar relationship with food, restrictions, and "cheating". However, the intention of this study was not only to consolidate the previous findings, but also to make a first attempt to generalize them: indeed, the hypothesized mechanisms that relates Food Involvement, food-evoked emotions, and the modulating role of Health Engagement, seem to be general mechanisms not specific for a clinical population. Future studies should try to export these methodology and findings (with the due

methodological considerations that will be discussed in the following "limits" section) to clinical populations, to further validate the findings and highlight potential peculiarities.

4.4.1 Limits, debriefing with participants, and future studies

This study has some limitations, that will however pose as a useful mean to indicate the path for future developments.

GSR and HR data didn't seem to reveal any particular significance, with only a few exceptions. This, as previously mentioned, is probably due to the on-screen duration of the food/drink stimuli and of the fixation crosses used as baseline: GSR and HR have a higher latency than PD, and possibly require longer recovery time. The set duration of the stimuli was probably not enough to allow a significant variation of these parameters. This potentially also impacted on the fact that PD was not different across stimuli, although this should be addressed in future studies.

During the debriefing with the participants another potentially critical aspect was the choice of the video used to induce a negatively-modulated mood. While the large majority of the participants indeed reported a neutral-to-negative mood after the vision of the videoclip, some reported that the video did not invoke "the kind of sadness that makes you want food", and that it actually "closed their stomach". The database we consulted for the choice of the video did not, in fact, keep this into consideration, while future studies should possibly try to identify a mean to modulate mood that might elicitate the specific feeling of sadness and distress that might more easily provoke an emotional reaction of attraction towards food in the subjects that are prone to use food as a mood-regulating tool. Indeed, future studies

should also try to have at least a control group (with a neutral stimuli) and a positive-mood group, as some studies also showed that even positive emotion might be the cause of binge eating and "misuse" of food (Cardi et al., 2015).

Some of the participants to this study (5/26) reported following some sort of alimentary regime due to personal choices. This may have introduced a bias in the choice task, as some selected foods and drinks could have been outright "undesirable" for the specific group as conflicting with their dietary choices or lifestyle. While removing this group does not seem to alter in a significant way the main results of this study, future studies should address this limitation and eventually try to assess whether these results could differ in population groups which adhere to diverse dietary choices.

Finally, the results seem to suggest a sort of moderating effect of HE on the relationship between FIS and food-evoked emotions, that lead to behaviors. A longitudinal study with proper daily behavioral registration of food intake, and real-time or intensive registration of experienced mood, might help to delve deeper into the relationship between these psychological characteristics of the individuals, their mood, the emotions they feel when exposed to food, and their actual behaviors. This would indeed require more sophisticated research designs, would be more invasive into participants' lives, and require different tools and technologies to collect data. Such a study, however, would shed light on the how engagement, mood, and food behaviors are intertwined and potentially help in designing patient- and consumer- centered interventions to foster a healthier diet.

4.4.2 Conclusions and practical implications

This study tried to delve deeper into the role that Food Involvement and Health Engagement play into emotional eating and food choices in a condition where mood has been manipulated to be more negative than the participants' baseline.

Interestingly, and regardless of the limitations that future studies should try to address, these results suggest that Health Engagement might play a role as moderator between Food Involvement (a rather stable characteristic of the individual) and the emotional activation at the sight of food in a poor mood situation. This might imply that consumers with a high Involvement towards Food are more prone to emotional eating and to be guided by emotions in food choices, but only if the engagement towards health is low; this suggests different mechanisms that guide food decision-making based on the involvement towards food and engagement towards health. These results might have interesting implications for the planning of educational interventions aimed at reducing emotional eating and other food-related behaviors (e.g. snacking) that overall lead to an unhealthy eating and lifestyle. Indeed, campaigns and educational interventions aimed at fostering Health Engagement might play an important role in promoting a healthier eating, in reducing behaviors such as snacking and emotional eating, and in an overall improvement of public health. However, the relationships between these psychological constructs (i.e.: Food Involvement and Health Engagement), emotional arousal, food choices, and unhealthy food-related behavior still show gaps that will have to be addressed in future research efforts.

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5. Concluding remarks

The general aim of this work was to delve deeper into the relationship between mood, health engagement, and food choices.

A first case study on which this work focused on were patients with Inflammatory Bowel Diseases: IBD patients were a very interesting field of study for our purpose, as food choices in their case have direct, potentially immediate and dire consequences on their health (Hou et al., 2014; Kinsey & Burden, 2016; Mehrabani et al., 2017). However, literature suggests that cheating and non-adherence are rather frequent phenomena in this population, often connected with feelings of depression, anxiety, or generally low mood (Day et al., 2021; Dubinsky et al., 2021; Wardle et al., 2018).

The first study (Chapter 2) described a scoping review (Armstrong et al., 2011) aimed at addressing and understanding the impact that food choices and restrictions exert on IBD patients' quality of life and psychosocial wellbeing. The 4-steps process (study identification, study selection, data extraction, results reporting and charting) led to the inclusion of 14 papers, with both qualitative, quantitative, and mixed methods. Overall, the literature retrieved was consistent with previous literature reviews and studies in clarifying that, even in the patients' perspective, food plays a fundamental role in the management of symptoms (Crooks et al., 2021; Limdi et al., 2016; Pituch-Zdanowska et al., 2019).

Although crucial, our review found that there is still some debate and ambiguity around the dietary recommendations that IBD patients should follow, and that as

a result patients find it difficult to adhere to a prescription and are often left alone in making dietary decisions based on their emotional status and unfounded convictions rather than a professional understanding of how nutrition affects their condition (Chuong et al., 2019; Schneider et al., 2009).

Moreover, a thematic analysis carried out on the results of these papers found that there are 3 main life domains that suffer consequences due to food restrictions: social life, family life, and personal well-being. Restricted access to food leads patients to a feeling of frustration and of "not being normal" (Czuber-Dochan et al., 2020; Fletcher & Schneider, 2006; Schneider et al., 2009), while also reducing their capacity to enjoy social gatherings and cultural events, managing their meals away from home, or enjoy a meal together with their loved ones (Alexakis et al., 2015; Czuber-Dochan et al., 2020; de Vries et al., 2019; Pituch-Zdanowska et al., 2019).

This scoping review highlighted some gaps in the knowledge on how food is lived by IBD patients, and how restrictions impact their well-being. In particular, the results show that the requested behavioral change regarding food is a cause of distress and lack of wellbeing for IBD patients that might lead to the use of food as a mood regulator (and, in particular, toward the consumption of such "comfort food" that are often included in the lists of trigger foods for IBD patients).

Nutritionists and gastroenterologists that take IBD patients into care should be aware of the consequences that the requested food restrictions they are "imposing" on their patients may impact on several, different aspects of their patients' lives (such as their family balance, for instance, or their social life): taking into account

this aspect, empowering patients in their health self-management appears extremely important for boosting adherence, quality of life, and well-being.

Chapter 3 of this work describes the second study, an online-based survey. The main purpose of this study was to delve deeper into the motivations that lead consumers (and, in this case, IBD patients) in the decision-making process of food choices, and in particular to investigate the role of two key psychological constructs (Health Engagement and Food Involvement) in profiling patients with different motivational characteristics. Literature suggested us a role of Health Engagement and Food Involvement in this. Indeed, patients with a higher Health Engagement are known to be more adherent to therapy and prescriptions (Chen et al., 2013; Graffigna et al., 2017), and overall to be more adapted to the behavioral changes imposed by their health condition (Graffigna & Barello, 2018); on the other hand, for IBD patients (but the same holds true for everyone, with due differences) health management passes through food management: literature shows that consumers with a higher Food Involvement tend to seek healthy food, but are also sensation seekers and search pleasure through food (Eertmans et al., 2005), which particularly in this case might be in conflict.

Results showed that it is possible to identify 4 groups of patients, each with peculiar main drivers regarding their food choices. The main and most interesting results are that patients with a low Health Engagement tend to report a more frequent use of food as a mean to regulate mood (e.g.: to manage distress, sadness, etc.). This vouches for a protective role of Health Engagement, as patients with a high level of Health Engagement are probably less likely to snack with comfort food

when of poor mood. Food Involvement plays a role in this too: results confirm the fact that people with a high Food Involvement are sensation seekers, and that pleasure is an important motivational driver for them. However, there seems to be an interesting interaction with Health Engagement: amongst those patients with a high Food Involvement, those with a high Health Engagement seek pleasure through food, but don't use it as a mean to regulate mood; those with a low Health Engagement, instead, see food as a mood modulator. This probably means that patients with a high Food Involvement and a low Health Engagement are those at a higher risk of "cheating" and non-adherence, as their drive to seek pleasure is not compensated by a good adaptation to the behavioral changes required by their health condition. Indeed, results show that this group is the one with the lowest food-related quality of life and overall worst well-being.

A study on IBD patients' motivations behind food choices might have some interesting implications for the practice, as it is a step forward in understanding *why* patients have difficulty in adhering to the recommended dietary behaviors. Moreover, profiling patients according to their psychological characteristics would help in (co-)designing and tailored interventions and strategies to foster a positive behavioral change, a better acceptance of the new lifestyle, and overall a better quality of life for patients.

Finally, Study 3 attempted at exporting some of these intuitions and findings onto a more general population. In particular, the study wanted to delve deeper into the role played by mood and emotions into behavior such as snacking and the choice of comfort food: literature suggests that a poor mood incentives emotional

eating, in particular regarding comfort food (AlAmmar et al., 2020). Given the results of the previous study, our claim was that Food Involvement and Health Engagement are mutually intertwined in determining how poor mood influences the preference for comfort food in a specific moment. For this study, we decided to bypass self-reported measures, and preferred a direct, behavioral measure: since literature suggests that food-evoked emotions are a strong predictor of preference and liking (Gutjar et al., 2015), and given that the theory on emotional eating suggests a rather unconscious underlying mechanism (Aarts & Dijksterhuis, 2000; Macht & Simons, 2011), we decided to measure arousal using a series of behavioral and physiological measures. In particular, we measured pupil dilation, blood volume pulse, and galvanic skin resistance. The main results of this study are coherent with the findings on the IBD sample of Study 2: after modulating mood to create a "sad" state, Food Involvement seems to be correlated with arousal at the sight of food and drinks (although in our study no differences were found between healthy and unhealthy snacks, possibly due to methodological aspects that need refining), but only when Health Engagement is low. This might indeed demonstrate that people with a high Food Involvement are more prone to emotional eating and to be guided by arousal, in a condition of poor mood, only if the engagement towards health is low; conversely, participants with a high Health Engagement didn't show the same correlation between Food Involvement and arousal, potentially suggesting different mechanisms that guide decision-making. Indeed, participants with a higher Health Engagement and interest towards an healthy diet tended to prefer healthier snacks and drinks in a decision task. Knowing how this mechanism works, and that there are differences between consumers with different profiles of Health

Engagement/Food Involvement, may help understanding behaviors such as emotional eating and snacking, which are potentially problematic not just for clinical populations, but for "healthy" consumers too since they may lead to unhealthy lifestyles. Understanding the unconscious and emotional roots of these behaviors, and how these are modulated by the psychological characteristics of the individuals, could potentially lead to intervention that (e.g. by the promotion of Health Engagement) may have important repercussions for the public health.

Table 20 summarized the key findings and the relevance of the studies described in this work.

As a final remark, it is important to notice that the empirical studies described in this work (Chapter 3 & Chapter 4) have been conducted in Italy, on sample composed of Italian participants.

When it comes to food, Italian culture shows some peculiarities, as food is an important aspect of our cultural identity (Almerico, 2014). The cultural context, and in particular the Italian one -with its own peculiarities regarding food- surely has an impact of how we perceive food, how we evaluate it, and how we choose it (De Dominicis et al., 2020; Laroche et al., 1998, van Rijswijk & Frewer, 2008). The generalizability of the findings presented in this thesis should thus be taken with a grain of salt in cultural contexts where food might have different social and cultural meanings and values, when compared to the Italian culture. Future studies should try to address the peculiarities of the Italian food culture in this regards, and potentially compare these findings in different food cultures, highlighting both differences and similarities.

Table 20: summary of the studies included in this thesis

Study	Key findings	Scientific relevance	Applicative relevance
1- A scoping review on the connection between food, mood, emotions, and IBD patients' psychosocial wellbeing	• even in the patients' perspective, food plays a fundamental role in the management of symptoms of IBD • there is still some debate and ambiguity around the dietary recommendations that IBD patients should follow • the dietary restrictions exert a dire impact on patients' personal, familiar, and social well-being • the resulting distress and poor mood may be an underlying cause of poor adherence to dietary recommendations	• the scoping review confirmed and highlighted that food restrictions in IBD patients are a critical aspect of their self-care, and require the patient to be aware and engaged in self-care • there are several gaps in literature still present on this matter, as not many studies were found on the psycho-social impact of food restrictions in this population, especially regarding younger patients in adolescence	• nutritionists and gastroenterologists that care for IBD patients should be aware of the consequences that the requested food restrictions they are "imposing" on their patients may impact on several, different aspects of their patients' lives • patients should be empowered in their health self-management, making them knowledgeable that they "can make it" • patients should be engaged into a process of self-care, co-creating strategies of dietary management with the healthcare professionals that fit both their health condition and lifestyle, fostering a positive behavioral change
2- Food-related behavioral patterns in patients with Inflammatory Bowel Diseases: the role of Patient Health Engagement and Food Involvement	• four clusters of patients were identified, based on their psychological characteristics of engagement towards health and involvement towards food • patients' with a higher Patient Health Engagement tend to have an overall better quality of life, mood, and health • patients' with a higher Food Involvement tend to seek pleasure through food: when this is not supported by a Health Engagement, it creates a risky situation in which	• this is the first study, to the best of our knowledge, that delves deeper into the motivations behind food choices of IBD patients related to their engagement • results show an important role of Patient Health Engagement as a potentially protective factor in reducing patients' motivation towards seeking comfort food	• profiling patients according to their psychological characteristics would help in (co-)designing and tailored interventions and strategies to foster a positive behavioral change, a better acceptance of the new lifestyle, and overall a better quality of life for patients.

	patients are pushed to seek comfort food to regulate poor mood		
3- The modulating role of health engagement and food involvement in emotional responses to food stimuli	• the results are coherent with study 2 findings, but extend the results to a general population instead of a clinic case study • In a condition of altered (low) mood, Food Involvement seems to be related to an activation, in terms of arousal, at the sight of food • this relationship, however, seems to exist only in a group of consumers with a low Health Engagement and low General Health Interest towards healthy food: this finding suggests that Health Engagement may modulate how consumers respond to food, and how the decision-making process takes place in a condition of altered mood	• the results of the previous study seems to be confirm the same intuitions on a more general sample, suggesting an underlying mechanism that goes beyond the specific case study of IBD patients • the relationship between Food Involvement an food-evoked arousal potentially suggests a role of emotions and unconscious processes in food decision-making for people with a high Food Involvement • however, results also show that Health Engagement may modulate this response, potentially altering the way decisions are taken in a condition of low mood and eventually reducing the chances of misbehaviors such as snacking and emotional eating	• promoting Health Engagement in consumers through campaign and educational interventions might play a role in reducing emotional eating and other behaviors that lead to an overall unhealthy lifestyle

5.1 References

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A sketch showing how Study 3 was actually carried out.

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