

FINDING SALVATION IN FOOD: SOCIAL AND INFORMATION INFLUENCES  
ON THE PERCEPTION OF FOOD FADS

A Thesis

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## ABSTRACT

This paper studies consumers' preferences towards gluten-free products. We aim at investigating what are the factors that potentially motivate a healthy individual who is free from CD (celiac disease) and NCGS (non-celiac gluten sensitivity) to follow a gluten-free diet. The empirical analysis of our experiment suggests that the provision of additional information regarding to gluten-free products has an impact on consumers' preferences of following a gluten-free diet. Additionally, the analysis indicates that consumers' preferences of following a gluten-free diet can be influenced by their personal characteristics (reading habits, family background, etc) and any cognitive distortions (overgeneralization bias, herd behavior, etc) they might have. Lastly, the paper discusses how following a gluten-free diet is correlated with consumers' future food consuming behaviors. The results imply that consumers are more willing to try and accept a brand-new food diet if they already followed a gluten-free diet.

## BIOGRAPHICAL SKETCH

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# Chapter I

## INTRODUCTION

Since 21st century, the public has been paying an increasing attention to the research of celiac disease (CD). The history between human beings and celiac disease can be dated back a long time ago. CD was first identified and named in the 1st century AD by Aretaeus of Cappadocia, a Greek physician. At the time, CD was named as “koiliakos” after a Greek word “koelia”. According to his description of symptoms, one would be defined to have “koiliakos” if his or her stomach is irretentive of food and cannot digest it (Guandalini 2007). Although this clever Greek physician’s description might be lack of accuracy and medical research in today’s medical standards, Aretaeus of Cappadocia’s contributions of discovering CD in human history cannot be neglected. Not until 19th century, human beings started to make a great breakthrough in understanding CD. In 1888, Samuel Gee, an English pediatrician, was recognized as the founder of the milestone description of CD in modern times. Based on his observation of children who suffered chronic issues in digesting food, Gee concluded that CD’s conditions would be cured through diet (Celiac Support Association 2016). In fact, Gee was not the only one who promoted a diet to cure CD in the 19th century. Dr. Mathew Baillie published similar results from his observations of a chronic diarrheal disorder on adults 75 years earlier than Gee (Guandalini 2007). Although Gee and Baillie could not identify the causes of CD’s conditions, their discoveries of CD made a great contribution to the introduction of a gluten-free diet later on.

After CD was introduced, many scientists devoted their entire lives in investigating the triggers of the disease and trying to develop a possible treatment. In 1924, Sidney Haas, an American pediatrician, came up his dietetic treatment called a “banana diet”. This dietetic treatment was defined as the cornerstone and also the breakthrough of dietetic treatment for CD’s conditions. Based on his treatment of eight children, Haas claimed carbohydrates to be the causes of having CD. Years after, William Dicke, a Dutch Pediatrician, made a great contribution in connecting wheat ingestion and CD in 1930s. He observed that the Children who suffered CD improved their health when they had less wheat to eat during Second World War. Later on, a biopsy technique was developed by Margot Shiner, a pediatric gastroenterologist, to check an individual’s small intestine in 1950s. She was able to observe the pathologic changes of CD. After that, the anti-gliadin antibody and associated other autoimmune diseases with CD were discovered in 1964 and 1980s respectively (Guandalini 2007). Because of all these efforts, CD was increasingly accepted as an autoimmune disease after 1990.

Nowadays, we have a considerably thorough understanding of CD and its effective treatment. According to National Institute of Diabetes and Digestive and Kidney Diseases, CD is defined as a disease that causes a digestive disorder which damages one’s small intestine. This disease is triggered by having food that contains gluten, a protein found naturally in wheat, barley and rye. Gluten is commonly existing in our daily foods and products such as, bread, pasta, cookies, lip balm, lip sticks, hair and skin products (National Institute of Diabetes and Digestive and Kidney Diseases 2016). According to some studies presented by Mayo Clinic, eating food that contains gluten would trigger an immune response from one’s own small intestine. The response would produce small intestine’s inflammation and damage the villi that line

the small intestine. Because villi plays an important role in absorbing vitamins, minerals and other nutrients from food, this overreaction from the immune system would therefore prevent the small intestine to absorb nutrients. As a result, this chronic damage would cause someone a weight loss, bloating and even severe diarrhea, which could hurt his or her brain, nervous system, bones, liver and other organ due to the lack of nourishments. The prevalence of CD in the United States is around 1 in 141 people. However, many of the cases are undiagnosed. In addition, many existing studies showed that CD is more prevalent among Caucasians than other races (Mayo Clinic and the National Institutes of Health). Having CD could be a severe issue to an individual's life. Developing an effective treatment of CD therefore has become significantly important and urgent to the CD patients. Because CD is triggered by having food that contains gluten, modern doctors treat CD by introducing a food diet called a gluten-free diet. Through imposing the diet, the doctors are able to improve their CD patients' health conditions noticeably. A gluten-free diet is considered the only treatment of CD until CD could be cured completely by any advanced medical discoveries in the future. This dietary treatment has been universally accepted and certified by the public.

A gluten-free diet was first introduced as the prescription of treating the CD patients which accounts approximately 1% of US population (Saner 2015). Later on, this prescription also has been increasingly applied to treat the patients who have Non-Celiac Gluten Sensitivity (NCGS) over the years. Similar as CD, NCGS is also an immune response if one has food that contains gluten. However, NCGS is clinically identified non-specific and less severe than CD. Additionally, NCGS is not accompanied by many characteristics CD demonstrates in its immune response and defined as non-genetically based (Beyond Celiac 2016). According to the definition

stated by Mayo Foundation for Medical Education and Research, NCGS is an immune response that describes gastrointestinal and/or extraintestinal symptoms from gluten ingestion. Clinically, NCGS's condition has features that overlap with many features CD has (Vazquez-Roque and Oxentenko 2015). A NCGS will cause someone abdominal pain, fatigue, headaches, tingling/numbness, etc. Although there are few laboratories or histological test that can be effectively applied to diagnose NCGS, a gluten-free diet has become the main prescription subscribed by modern doctors to treat NCGS. Based on the current studies, it is estimated that approximate 6% of the US population is affected by NCGS (Beyond Celiac 2016). All of these imply that only around 7% of the US population is medically subscribed with a gluten-free diet for improving their health conditions. However, there is a big disconnection between this minority's consumption of gluten-free products and the rapid sales of gluten-free products in the society (Mansharamnai 2015).

According to a consumer survey conducted by NPD Group in 2013, 30% of American adults are intending to have gluten-free products to reduce or exclude the amount of gluten they absorb in their daily diets (Watson 2013). As a result, there has been an increasing amount of gluten-free products available in the public. A lot of pet foods are even made into gluten-free and sold in many grocery stores. Outside of grocery stores, gluten-free dining has been recognized a fast growing business. Numerous restaurants started to propose their gluten-free menus to their customers. In Del Posto<sup>1</sup>, there would be at least one gluten-free dish served in one third of the tables in the restaurant (Severson 2014). Additionally, gluten-free products have caught lots of attention from the general public's social media. The dietary book, "Wheat Belly: Lose the Wheat, Lose the Weight and Find Your Path Back to Health", wrote by Dr. William Davis, was published in 2011. Davis proposed his idea of avoiding

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<sup>1</sup>One of the most expensive restaurants in New York City.

today's wheat and gluten in his book. According to the New York Times, Davis's book became the No.1 seller on the New York Times Best Sellers shortly after it was published (Quick 2012). Gwyneth Paltrow, a famous Hollywood star, had made her family to avoid gluten by following a gluten-free diet since 2013. She even included many her gluten-free diet recipes in her cook book called "It's All Good" (Malec 2014). Interestingly, fighting against gluten was even shown in a popular American adult anime called *South Park*. In an episode played in the October of 2015, the entire town in South Park was trying to avoid gluten (Saner 2015).

"But today, if you aren't gluten-free, you likely know someone who is or is trying to be. The style of eating has become a way of life for many and a national punch line for others."

(Severson 2014)

The retail sales of gluten-free products increased to a height which we never pictured before. In 2011, the retail sales of gluten-free products were 7,338 million dollars. The sales increased to 15,586 million dollars in 2016. Although there was a slow decreasing trend of the sales growth after 2013, the sales growth of gluten-free products in the US is still considered to be fairly high overall (Statista 2016). In fact, consuming gluten-free products has been becoming a world widely trend. In 2014, the sales of Gluten-free diet had a 15% increase from 2013 in UK. It reached £184m in the year. Also, in every 10 new food products introduced to the public, one of them was defined as gluten-free. By estimations, this number is almost twice as many as it was two years ago in UK (Saner 2015). The amount of retail sales of gluten-free products is estimated to keep fast growing. As we have indicated, a gluten-free diet is medically necessary to only 7% of the US population. All of these rapid growths of the sales of gluten-free products demonstrate that there is a fairly large amount of people in our society who do not have a CD or NCGS starting to follow a gluten-free diet.

Many surveys have indicated that the top reason for individuals who are free from non-CD or non-NCGS to choose to eliminate gluten is they generally consider gluten-free products are healthier than their counterparts that contain gluten. According to a consumer survey in 2012 conducted by Packaged Facts, more than 80% of costumers thought gluten-free products are generally healthier or helping to manage a weight loss (Watson 2013). Many of them claimed that gluten-free products are more nutritious, low-carb and low-calories. By having a gluten-free diet, they believe that they are able to deal with the issues of feeling fatigue, manage a weight loss and improve their overall health conditions. However, there are few scientific studies published that support these health benefits of following a gluten-free diet. Avoiding gluten from consuming gluten-free products may not help an individual who is free from CD or NCGS to have an improved health condition (Gaesser & Angadi 2012). In fact, following a gluten-free diet is not medically necessary and can be risky to the individuals who are free from non-CD or non-NCGS.

First, according to many studies published in the Journal of Medicinal Food, we had no evidence to show a gluten-free diet is actually helping an individual to lose her weight. Instead, many researchers claimed that the diet could make an individual to actually gain weight. They believed that the ways of making a food gluten-free would cause the food to have more calories, sugars, and fat than its counterparts in the food market (Consumer Reports 2014). According to some studies presented by Consumer Reports, for the same amount of serving, Whole Foods gluten-free blueberry muffin has more calories, fat, sodium and sugars than Walmart blueberry muffin. This relationship is widely applied to many other gluten-free food products in the market. In fact, a cutting of unhealthy food and the total amount of food eaten throughout a gluten-free diet could actually play the key role of contributing to an individual's

weight loss (Consumer Reports 2014). Thus, an individual faces a risk of gaining weight from eating gluten-free products. Second, many existing studies of food nutrition declared that gluten-free products are not necessarily more nutritious. According to a survey conducted by Consumer Reports, 25% of the survey participants believed that gluten-free products contain more vitamins and minerals than its counterparts in the market. In fact, many gluten-free products are lack of folic acid and iron compare to their counterparts. Consequently, following a gluten-free diet could make an individual to lack of nutrients if she is not positively diagnosed with CD or NCGS. Finally, having a gluten-free diet could cause an individual to consume more arsenic in her daily foods than a desired amount. According to Consumer Reports, majority of currently existing gluten-free products contain rice or rice related ingredients. As a result, an individual would consume more rice or rice related products after following a gluten-free diet. However, many of rice or rice packaged products in the US contain some levels of arsenic. Studies showed that more than 17% of an individual's consumption of arsenic is from rice or rice related products nowadays. Therefore, an individual could consume a significant amount of arsenic from following a gluten-free diet, which would be harmful to her health condition in a long run (Consumer Report 2014). All of the issues demonstrate the severity of health risks from following a gluten-free diet. Dr. Alessio Fasano, the director of Center for Celiac Research at Massachusetts General Hospital in Boston, stated that individuals who are free from celiac disease or NCGS should not follow a gluten-free diet (Consumer Report 2014). Additionally, many other clinical studies (Hallert et al., 2009; Howard et al., 2002; Ohlund et al., 2010; Wild et al., 2010) made a similar claim (Pember and Rush, 2016). Following a gluten-free diet without being diagnosed with CD or NCGS is not recommended. This fad diet also indicates the general public's deficiencies in understanding gluten-free products. An investigation of people's behavior of following a gluten-free diet is necessary and urgent to the government authorities.

## Chapter II

### LITERATURE REVIEW

In year 2002, Mustalahti et al. evaluated the effect of a gluten-free diet on the quality of life of patients who are screen diagnosed with celiac disease. Although advanced technologies have been contributing to screen detect celiac disease, the overall effect of a gluten-free diet on the quality of life of the celiac disease patients is unclear. Therefore, Mustalahti et al. designed an experiment to measure Gastrointestinal Symptoms Rating Scale (GSRS) and quality of life measured with the Psychological General Well-Being Questionnaire (PGWB) for both screen-detected and symptom-detected celiac disease patients before and one year after initiating a gluten-free diet. The study's results demonstrated that the adoption of a gluten-free diet has positive correlation with the improvement of the quality of celiac disease patients. A year later, Fasano et al. examined the prevalence of Celiac Disease (CD) in at-risk and not-at-risk groups in the US. Fasano et al. applied an experiment to screen subjects and measured the rate of having serum antigliadin antibodies and antiendomysial antibodies (EMA). According to this study, a positive tested EMA occurred associated with human tissue transglutaminase IgA antibodies and CD-associated human leukocyte antigen DQ2/DQ8 haplotypes, which implies a proven CD. The study's results indicated that the rate of occurrence of CD among in at-risk groups is 1:22 in first-degree relatives of patients, 1:39 in second-degree relatives of patients and 1:56 in symptomatic patients. In not-at-risk groups, the overall rate of occurrence of CD is 1:133. Fasano et al. claimed that current diagnosed CD rate is underestimated in the US. Therefore, historically, gluten-free diet and Celiac Disease have been popularly examined in clinical studies.

In this study, we aim at investigating what are the potential factors that motivate a healthy individual of non-CD or non-NCGS community to follow a gluten-free diet. However, there are few studies that particularly analyze the consuming behavior towards gluten-free products. As a result, for our research purposes, it is important to look through some existing studies that investigate a consumer's choice preferences. First of all, Morkbak and Nordstrom (2009) examined a consumer's choices in relation to animal food products and how her consuming preferences are affected by information. The authors conducted a choice experiment. In this study, chicken products are divided into reared indoors and outdoors. In addition, these products are divided into campylobacter-free labeled and non-labeled. According to the choice experiment, Morkbak and Nordstrom claimed that there is a positive willingness to pay (WTP) from consumers for chicken either reared outdoors or campylobacter-free labeled. Additionally, information about rearing methods leads a higher WTP for chicken reared outdoors. However the provision of the information about campylobacter has both positive and negative effects on consumers' WTP. Second, Fonner and Sylvia (2015) examined a consumer's willingness to pay (WTP) for seafood products when the products are attached with different information labels. The authors investigated how a consumer's choices change over the information labels. In this study, the types of seafood information labels are divided into safety, quality, local and ecolabels for the selected two seafood species. Fonner and Sylvia measured the WTP of the seafood products towards each information label. This study indicates that each label is positively related with a consumer's WTP, with local labels and ecolabels have the largest positive influence among all the information. Additionally, ecolabels have a wider range of influence on WTP and effects of local labels are not affected by the additional information labels for the same seafood products. Lastly, Ahn et al. (2015) studied an individual's consuming preferences towards red ginseng

concentrate under different information. According to this study, red ginseng concentrate is a fairly popular food product in Asia. Consumers usually have their own objective information about the product's attributes which affects their willingness to pay (WTP). Ahn et al. conducted a two-round choice experiment that monitored consumers' responses of WTP under their personal beliefs and subjective information or after the provision of objective information about the product's attributes. This study demonstrates that consumers' preferences could be affected by an asymmetric information issue. In addition, it indicates that objective information can cause changes to the valuation of different attributes of red ginseng concentrate and also contribute to the WTP of the products.

These studies provide a case of analyzing how the provision of information and the information's contents affect a consumer's choice preferences in the food market. Inspired by all of these, we also introduced a choice experiment of providing reading information of gluten-free diet and vitamin A<sub>e</sub>-free diet<sup>1</sup> in our online surveys. By monitoring the responses from the participants, we intend to examine how a consumer's preferences towards gluten-free products change over the information. In the next chapter, we introduce our hypotheses of the study, the reduced forms of the study's empirical model and the associated empirical analysis. Finally, we have our conclusion in the last chapter.

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<sup>1</sup>We would like to state that the information of vitamin A<sub>e</sub>-free diet and SugarDev included in the vitamin A<sub>e</sub>'s reading passages were made-up. There is no vitamin called A<sub>e</sub> and its associated health knowledge is not real either. This design in our experiment allows us to monitor consumers' responses to the new information. It enables us to investigate an individual's future consuming behavior towards a brand new food diet.

## Chapter III

### ANALYSIS

#### ***3.1 Research Hypotheses***

In this paper, we focus on analyzing a food diet behavior, particularly a gluten-free diet following behavior, non-CD or non-NCGS community exhibited in the food market. We examine how individuals of non-CD or non-NCGS community respond to their allocation of different publicly available information in making their decisions of following a gluten-free diet. The way one processes information often follows a psychology of learning. The psychology of learning in information-processing has been heavily studied by scientists since a long time ago (e.g. James 1890; Boggs 1907; Anderson 2015). William James, the father of American psychology, is the first educator who offered a formal psychology course in the US in the late 19th century and early 20th century (Pajares 2002). The book he published in 1890, *The Principles of Psychology*, is still studied today to understand human's mind and behavior. Nowadays, the way of understanding human's mind and behavior has evolved into a perspective of cognitive psychology. One processes the information and updates her learning of the world strategically, which influences her behavior in either short or long term. Anderson (2015) indicated in his book, *Cognitive Psychology and Its Implications*, that information-processing approach has become the major method to study human cognition. According to this scenario, we introduced a perspective of cognitive learning into our analysis of an individual's consuming preference of gluten-free products. When a consumer is provided additional information of a gluten-free diet, she would update her current learning of the diet based on all the information she newly received in a systematical process of psychology of learning. This leads us

to suggest the following hypothesis.

***Hypothesis 1.* Having additional positive information of gluten-free products would motivate a healthy individual of non-CD or non-NCGS community to follow a gluten-free diet.**

We examine the impact of providing additional information of a gluten-free diet by comparing individuals' willingness of following the diet when they are provided additional positive, natural or negative information of gluten-free products. By controlling all other background characteristics, we focus on testing whether there are any significant differences among the measured willingness.

When one processes her information in a systematical psychology of learning, there is a potential of experiencing confirmation bias. This cognitive bias has been identified by many previous psychological studies (e.g. Brunner & Potter 1964; Lord, Ross & Lepper 1979; Darley & Gross 1983). As Rabin and Schrag (1999) introduced in their paper, *First impressions matter, a model of confirmation bias*, one would misinterpret ambiguous evidence as confirming her current hypothesis about the world if she experienced confirmation bias in her beliefs. Many behavioral economics literatures also included confirmation bias into their analysis of an individual's decision-making process (e.g. Rabin & Schrag 1999; Lockwood 2015). Hence, we introduced the bias into our analysis of the consuming preference of gluten-free products. This leads us to propose the following hypothesis.

***Hypothesis 2.* A healthy individual of non-CD or non-NCGS community who is a weaker believer of following a gluten-free diet would be motivated to follow the diet if she receives additional information of gluten-free products.**

Intuitively, when a weak believer of following a gluten-free diet or not following a gluten-free diet receives additional new information of gluten-free products, confirmation bias in her information-processing would “confirm” the correctness of her current beliefs. As a result, this individual would become more motivated to follow or not follow the diet. In our analysis, we introduced a completely brand new food diet called vitamin A<sub>e</sub>-free diet. We first compared individuals’ willingness of following a gluten-free diet and their willingness of following a vitamin A<sub>e</sub>-free diet. We then compared individuals’ willingness of following a gluten-free diet when they were provided positive, natural or negative information of gluten-free products. By controlling all other background characteristics, we aim at testing if there is a big difference between the willingness of following a gluten-free diet under the positive information and the willingness of following a gluten-free diet under the negative information.

We also examine how an individual’s decision of following a gluten-free diet is affected by her demographic characteristics, such as income, education and being familiar with gluten-free products. Following a food diet is usually an additional cost to a health individual. To an individual who has a relatively low income, because of the high expenses of gluten-free products, she will be more unlikely to follow the diet. Intuitively, having a high income would make the individual to be more inelastic to the high prices of gluten-free products. The rationality of income elasticity of demand has been well introduced in the introduction level of Microeconomics and Macroeconomics. This fundamental economic theory has been popularly applied in many different fields of studies (e.g. Vita & Abbott 2004; Fernandez-Kranz & Hon 2006; Asali 2011). Therefore, this leads us to suggest the following hypothesis.

***Hypothesis 3.* A healthy individual of non-CD or non-NCGS community who has a relatively high level of income would be**

**more willing to follow a gluten-free diet.**

We examine the impact of income level on an individual's decision of following a gluten-free diet by comparing the willingness of following the diet among the individuals who have different income levels. By controlling all other background characteristics, we focus on testing if there are any significant differences among the willingness we measured.

To assess whether education level affects an individual's willingness of following a gluten-free diet, we examine the impact by comparing the willingness of following the diet among the individuals who have different education levels. It is commonly known that following a diet without having sufficient studies of this diet could greatly affect one's health condition. If a health individual has a high level of education, she would rely more on her knowledge to help her to decide to follow a diet or not. When a health individual is less educated, she could become more risk averse in her decision of following a diet. Therefore, we suggest a following hypothesis.

***Hypothesis 4.* A healthy individual of non-CD or non-NCGS community who has a relatively high level of education would be more willing to follow a gluten-free diet.**

In this case, we aim to test if there are any significant differences among the willingness we measured after controlling all other background characteristics.

By controlling all other background characteristics, we compared the willingness of following a gluten-free diet between the individuals who are familiar with gluten-free products and the individuals who are not. We aim to evaluate whether an individual is familiar with gluten-free products would influence her willingness of following a gluten-free diet. Intuitively, one tends to be more hesitant in her food choices if she is

unfamiliar with the food products. If a health individual is not familiar with gluten-free products, she would not have enough learning of a gluten-free diet. Because of this lack of learning, the individual could be less confident and become more risk averse in deciding to follow the diet. Hence, being familiar with gluten-free products or not could significantly affect an individual's behavior of following a gluten-free diet. Many researchers have examined a similar impact of familiarity on consumers' behaviors (e.g. Park & Lessig 1981; Simonson 1990; Serenko & Bontis 2011). In *The Effect of Buying Decisions On Consumers' Assessment of their Tastes*, written by Itamar Simonson (1990), consumers chose how to self-assess their weights based on their familiarity with the products they consumed (Simonson 1990). Also, Serenko and Bontis (2011) indicated in their studies that consumers assigned higher ranks to the journals which they are more familiar with. Inspired by all of these, we propose a following hypothesis.

***Hypothesis 5. A healthy individual of non-CD or non-NCGS community will be more likely to follow a gluten-free diet if she is familiar with gluten-free products.***

Furthermore, we investigate how non-CD or non-NCGS community's decisions of following a gluten-free diet are affected by individuals' cognitive distortion and their behaviors in a group. First, we analyze how an individual's self-evaluation of her daily diet affects her willingness of following a gluten-free diet. When an individual is making a decision, the information she collected could be insufficient for understanding the entire image of the world. Because of this, she could over generalize her learning of the information and make biased conclusion, which would heavily affect her behavior. This cognitive distortion is identified as overgeneralization (hasty generalization) and has been well studied by many psychologists (e.g. Dawes 1964; Beck 1976; Burns 1980). As Dawes (1964) indicated in his paper, *Cognitive Distortion*, that one would

have more confidence in her decision-making process if she experienced overgeneralization. According to this scenario, we introduced a perspective of overgeneralization into our analysis of an individual's consuming preference of gluten-free products. If an individual evaluates her daily diet to be fairly healthy, she might become overconfident and claim her future choices of food products to be healthy as well. As a result, the individual would become more prone to follow a gluten-free diet. All of this leads us to suggest the following hypothesis.

***Hypothesis 6.* A healthy individual of non-CD or non-NCGS community who has a higher self-evaluation of the health level of her daily diet is more willing to follow a gluten-free diet.**

By controlling all other background characteristics, we examine how the willingness of following a gluten-free diet varies with the health degree an individual evaluates her daily diet. Second, it is commonly known that individuals also consider other people's information in making their decisions. According to Banerjee (1992) stated in his paper, *A Simple of Herd Behavior*, herd behavior refers to a phenomenon that an individual trying to use other people's information to make a decision without considerably factoring in her own information. Many different fields of studies have researched the impact of herd behavior on an individual's behavior (e.g. Scharfstein & Stein 1990; Banerjee 1992; Rook 2006; Balcilar & Demirer 2015). For our research purposes, we introduced a perspective of herd behavior into our analysis of an individual's consuming preference of gluten-free products. When an individual observes her community (e.g. friends, family, colleagues, etc.) following a gluten-free diet, if she experiences herd behavior, she would take her community's decision as her own without factoring in her individual information. Intuitively, this motivates the individual to follow the diet. Because of this, we propose a following hypothesis.

***Hypothesis 7.* A healthy individual of non-CD or non-NCGS**

**community is more willing to follow a gluten-free diet if she observes her community also following the diet.**

We first allowed individuals to observe each given group's behavior of following a gluten-free diet. We measured their willingness of following the diet afterwards. By controlling all other background characteristics, we focus on testing whether there are any significant differences among the willingness we measured.

Finally, we investigate whether following a gluten-free diet would affect an individual's future consuming behavior towards other food products. Intuitively, an individual of non-CD or non-NCGS community would depend on both her inside information (personal characteristics) and the outside information of a gluten-free diet she collected to make the decision of following a gluten-free diet. Hence, when she is considering following another diet or not, she needs to recollect the outside information of this particular food product. If this newly considered food diet has few noticeable similarities with a gluten-free diet, the individual's decision of following the diet should be independent to her consuming behavior of following a gluten-free diet. Thus, we propose the following hypothesis.

***Hypothesis 8.* Following a gluten-free diet has no impacts on motivating a healthy individual of non-CD or non-NCGS community to follow a brand new food diet.**

We first divided the experiment samples (the individuals who are free from CD and NCGS) into two groups, the individuals who chose to follow a gluten-free diet and the individuals who did not. We then compared the individuals' willingness of following a vitamin A<sub>e</sub>-free diet between these two groups. We focus on testing whether there are any significant differences between them.

Overall, our summarized research questions are the following:

1. *What are the potential factors that could motivate a healthy individual of non-CD or non-NCGS community to follow a gluten-free diet?*
2. *How does the behavior of following a gluten-free diet affect an individual's future consuming behavior towards other food products?*

### **3.2 Experiment Designs**

The method of collecting data for this study is launching an online survey. The designed survey is randomly distributed through Amazon Mechanical Turk (MTurk). The total number of the reported observations is 613. Based on the information provided by the survey participants, we investigate any potential factors that could motivate a healthy individual of non-CD or non-NCGS community to follow a gluten-free diet. Additionally, we are able to conduct an analysis to understand how the behavior of following a gluten-free diet could affect an individual's future food consuming behavior.

To address our research questions, we designed our survey into six different versions, defined as survey A<sup>1</sup>, B, C, D, E and F. Each of the surveys has three sections (Section 1, 2 and 3) of questions. The total number of each survey's questions is the same and equals to thirty-nine. At the beginning of Section 1 and Section 3 of the surveys, each has a short reading passage. We required every participant to read the passages before answering any following questions in the survey. The short reading passage is assigned from two reading passage groups, defined as gluten-free diet information and vitamin Ae+-free diet information. In gluten-free diet information, there are three different reading passages, defined as GlutGood, GlutBad and GlutNeut<sup>2</sup>.

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<sup>1</sup>The designed questions of all the surveys are the same. A collection of Survey A's questions are attached in the appendix as a reference.

<sup>2</sup>GlutGood is a short passage that promotes good information of a gluten-free diet. GlutBad is

Similarly designed, there are three different reading passages (VitGood, VitBad and VitNeut<sup>3</sup>.) in vitamin Ae+-free diet information. The reading passage given in the beginning of Section 1 of each survey is chosen from one of the reading passages of vitamin Ae+-free diet information. And the reading passage given in the beginning of Section 3 of each survey is chosen from one of the reading passages of gluten-free diet information. In this experiment, survey A contains VitBad and GlutGood, survey B contains VitNeut and GlutGood, survey C contains VitGood and GlutBad, survey D contains VitNeut and GlutBad, survey E contains VitGood and GlutNeut and survey F contains VitBad and GlutNeut. This particular design of assigning reading passages in each version of survey enabled us to adjust the measurement error<sup>4</sup> occurred in collecting our data. In addition, these six versions of survey are evenly distributed such that the total number of the participants in each version of survey is approximately the same<sup>5</sup>. Finally, we required all the participants of this online survey to be at least eighteen years old.

### ***3.3 Empirical Model***

In this section, we propose our empirical model to examine what are the potential factors that motivate a healthy individual of non-CD or non-NCGS community to follow a gluten-free diet. To investigate what these potential factors are, we use the data collected in the choice experiment we distributed online. As we have introduced in our experiment designs, there are six different versions of surveys which are

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a short passage that promotes bad information of a gluten-free diet. Finally, GlutNeut is a short passage that promotes neutral information of a gluten-free diet.

<sup>3</sup>VitGood is a short passage that promotes good information of a vitamin Ae+-free diet. VitBad is a short passage that promotes bad information of a vitamin Ae+-free diet. Finally, VitNeut is a short passage that promotes neutral information of a vitamin Ae+-free diet

<sup>4</sup>The participant of this experiment might learn to adjust his consuming behavior throughout the survey if we offered him same type of positive, negative or neutral reading passages in both Section 1 and 3. This would cause a measurement error in collecting our data.

<sup>5</sup>The six versions of survey are designed in Cornell Qualtrics and launched at Amazon Mechanical Turk. The total number of the participants in each version of survey is around one hundred. We compensated each participant one US dollar to complete the survey.

evenly distributed to the participants and the total number of reported observations is 613. For our research purposes, we keep the participants who are free from CD and NCGS in our samples. In this study, we record the survey participants' responses of willingness to follow a gluten-free diet (WTFG) as the measurement of consumers' preferences towards gluten-free products.

We consider  $WTFG_i$  to be a function of vitamin Ae+-free diet information, gluten-free diet information and other demographic characteristics, such as gender, age, income, education level, etc. We define the information status  $VitInfo_i$  and  $GlutInfo_i$  each as a deterministic and discontinuous function of whether a particular type of reading passage is chosen from the two information groups and provided to the survey participants to read. The defined functions of  $VitInfo_i$  and  $GlutInfo_i$  are given below.

$$\begin{aligned}
 & VitInfo_i = \\
 & \left\{ \begin{array}{l} VitGood \\ VitBad \\ VitNeut \end{array} \right\} \left\{ \begin{array}{l} = 1, \text{ if the passage at the beginning of Section 1 is VitGood;} \\ = 0, \text{ if the passage at the beginning of Section 1 is not VitGood.} \\ \\ = 1, \text{ if the passage at the beginning of Section 1 is VitBad;} \\ = 0, \text{ if the passage at the beginning of Section 1 is not VitBad.} \\ \\ = 1, \text{ if the passage at the beginning of Section 1 is VitNeut;} \\ = 0, \text{ if the passage at the beginning of Section 1 is not VitNeut.} \end{array} \right. \\
 & \\
 & GlutInfo_i = \\
 & \left\{ \begin{array}{l} GlutGood \\ GlutBad \\ GlutNeut \end{array} \right\} \left\{ \begin{array}{l} = 1, \text{ if the passage at the beginning of Section 3 is GlutGood;} \\ = 0, \text{ if the passage at the beginning of Section 3 is not GlutGood.} \\ \\ = 1, \text{ if the passage at the beginning of Section 3 is GlutBad;} \\ = 0, \text{ if the passage at the beginning of Section 3 is not GlutBad.} \\ \\ = 1, \text{ if the passage at the beginning of Section 3 is GlutNeut;} \\ = 0, \text{ if the passage at the beginning of Section 1 is not GlutNeut.} \end{array} \right.
 \end{aligned}$$

Therefore, according to the designs of our surveys, the potential outcome of the information status  $VitInfo_i$  and  $GlutInfo_i$  can be described as one of the following six cases.

$$\left\{ \begin{array}{l} VitInfo_i = VitBad = 1, \quad GlutInfo_i = GlutGood = 1 \\ VitInfo_i = VitNeut = 1, \quad GlutInfo_i = GlutGood = 1 \\ VitInfo_i = VitGood = 1, \quad GlutInfo_i = GlutBad = 1 \\ VitInfo_i = VitNeut = 1, \quad GlutInfo_i = GlutBad = 1 \\ VitInfo_i = VitGood = 1, \quad GlutInfo_i = GlutNeut = 1 \\ VitInfo_i = VitBad = 1, \quad GlutInfo_i = GlutNeut = 1 \end{array} \right.$$

This leads to the following reduced form of our empirical model.

$$\mathbf{Model\ 1} : WFTG_i = \alpha_0 + \beta_1 VitInfo_i + \beta_2 GlutInfo_i + \beta_3 X_i + \xi_i$$

where  $X_i$  is the vector of other demographic characteristics we introduced above. Additionally, in order to address the issue of heteroskedasticity in this model, the model's standard errors are measured in the robust standard errors. This equation is the reduced form of the effects of information and demographic characteristics on an individual's choice preferences towards gluten-free products. After running this regression, we are able to observe how the information and other demographic characteristics affect a healthy individual of non-CD or non-NCGS community to follow a gluten-free diet.

In order to have a deeper understanding of these effects, we also analyze how the information and other demographic characteristics affect consumers' choice preferences towards a brand new food diet. Similarly constructed, we record the survey participants' responses of willingness to follow a vitamin Ae+-free diet (WTFV) as the measurement of consumers' preferences towards vitamin Ae+-free products. In this case, we also consider  $WTFV_i$  to be a function of vitamin Ae+-free diet information, gluten-free diet information and other demographic characteristics which we

have introduced in the case of following a gluten-free diet. This leads the following reduced form of our empirical model for  $WTFV_i$ .

$$\text{Model 2 : } WTFV_i = \lambda_0 + \theta_1 VitInfo_i + \theta_2 GlutInfo_i + \theta_3 X_i + \mu_i$$

where the model's standard errors are also measured in the robust standard errors. After running this regression, we are able to observe how the information and other demographic characteristics affect a healthy individual of non-CD or non-NCGS community to follow a vitamin Ae+-free diet.

### 3.4 *Results*

First of all, Table 1 & Table 2 include the first part of the results from the regressions of Model 1 and Model 2. The results of Model 1 (the willingness to follow a gluten-free diet) and Model 2 (the willingness to follow a vitamin Ae+-free diet) are presented in the second and the first column respectively. As the tables indicate, consumers respond differently when they are exposed to different types of information. Consumers who received positive information of a vitamin Ae+-free diet are motivated to follow the diet. They are less willing to follow the diet if the information they received are negative. The effects of these two types of information on consumers' choice preferences towards vitamin Ae+-free products are tested significantly different from 0. This conforms to our expectations as consumers exhibit higher/lower willingness to follow a brand new food diet when they are provided positive/negative information. However, the effects do not fully coincide with consumers' choice preferences towards gluten-free products. We find no evidence to show that having negative information of a gluten-free diet would impose an adverse influence on a consumer's willingness to follow the diet. Instead, the tables only show that consumers are more apt to follow a gluten-free diet if the provided information of gluten-free products is positive. One possible explanation for this result is that consumers have pre-existing beliefs about a gluten-free diet. When she was provided

additional positive information of gluten-free products, she would update her current learning of the diet and become more apt to accept gluten-free products. When the given information is negative, her pre-existing beliefs about a gluten-free diet would prevent her learning of the diet from being updated. As a result, in this process of psychology of learning regarding to a gluten-free diet, the consumer weights more on the positive information than the negative information. The findings support our hypothesis **H1**. Nevertheless, they are not supportive to our hypothesis **H2**. As we have discovered above, the positive/negative information of a vitamin Ae+-free diet imposes an encouraging/adverse influence on a consumer's choice preferences. This implies that information dose play a role in affecting a consumer's food consuming behavior. However, we have no evidence to show that the effects of having positive and negative information on a consumer's willingness to follow a gluten-free diet are significantly different from each other. Intuitively, when a weak believer of following/not following a gluten-free diet receives additional new information of gluten-free products, a potential confirmation bias in her information processing would "confirm" the correctness of her current beliefs. This implies the individual would become more motivated to follow/not follow a gluten-free diet. Hence, the findings contradict our expectations as stated in **H2**.

Secondly, Table 1 & Table 2 also illustrates that there are no noticeable evidence to show that an individual's income and education levels have any impacts on her willingness to follow a gluten-free diet. We only observe a strong negative impact from an education degree (less than high school) on a consumer's willingness to follow a vitamin Ae+-free diet. The results indicate that a consumer who is severely lack of education would be much more unlikely to follow a vitamin Ae+-free diet. One possible explanation for this is that a consumer who is severely lack of education is a lot more risk averse in trying out a brand new food diet. As we have claimed in our

section of hypotheses, when a consumer is severely lack of education, she probably could not rely on her knowledge in making her decisions of following a diet. Therefore, this consumer becomes highly risk averse in facing a brand new food diet. However, we cannot observe any additional evidence about this correlation between education and risk aversion in a consumer's behavior of following a gluten-free diet. As a result, the findings we have are not supportive to our hypotheses **H3** and **H4**.

Finally, two additional results of Table 1 & Table 2 stand out with respect to a consumer's familiarity with CD and her self-evaluated level of daily diets. First, we observe a positive impact on both willingness of following a vitamin Ae+-free diet and willingness of following a gluten-free diet when a consumer is not familiar with celiac disease. The positive effects of not being familiar with celiac disease on the willingness are tested significantly different from 0. However, we find no evidence to claim that not being familiar with a gluten-free diet has any impacts on a consumer's willingness to follow a gluten-free diet. Because a gluten-free diet is identified as the only treatment of curing celiac disease, a gluten-free diet is closely related to celiac disease. Therefore, this implies that a consumer who is not familiar with celiac disease should be also unfamiliar with a gluten-free diet intuitively. If not being familiar with celiac disease imposes a strong positive impact on a consumer's willingness to follow a gluten-free diet, we are expecting to observe a similar positive impact from not being familiar with a gluten-free diet. Hence, the given results are contradicted to our intuitions. These findings are not supportive to our hypothesis **H5** and its associated possible explanations are not clear. Second, Table 1 & Table 2 also show that a consumer who has a higher self-evaluation of her current daily diet's health level is more willing to follow a gluten-free diet. This positive impact is also identified on affecting a consumer's willingness to follow a vitamin Ae+-free diet. Both effects are tested significantly different from 0. These findings are supportive to our

hypothesis **H6**. As we have introduced, if an individual evaluates her daily diet to be very healthy, she might become over confident and conclude that her future choices of food products will be also healthy. This motivates her to follow a gluten-free diet. Finally, we observe that a consumer who has no family members following a gluten-free diet is less apt to follow a gluten-free diet. This negative effect is strong and tested significantly different from 0. One possible explanation for this result is that a consumer could gain a lot of confidence and supports in deciding to follow a gluten-free diet from her family if any of her family members following the diet. Because of this, she would become less risk reverse towards gluten-free products. All of these findings demonstrate great sources that could affect a consumer's choice preferences of following a gluten-free diet.

The second part of the results from the regressions of Model 1 and Model 2 is given in Table 3 & Table 4. According to the tables, two results stand out with respect to a consumer's gender and her information sources where she mainly received her information about a gluten-free diet. We first observe a negative gender effect of being female on one's willingness to follow a vitamin A<sub>e</sub>-free diet. This negative effect is weakly measured and tested significantly different from 0. Secondly, we do not observe any gender effects on the willingness of following a gluten-free diet. The associated possible explanations about the gender effects are not clear. The second noticeable result of Table 3 & Table 4 demonstrates that where an individual mainly received her information about a gluten-free diet matters. According to the tables, we observe a strong negative impact on the willingness of following a gluten-free diet from the information source of magazine and newspapers. It implies that a customer is much less willing to follow a gluten-free diet if she mainly received her information about the diet from magazine and newspapers. This strong effect is measured significantly different from 0. One possible explanation for this is that the articles written

in magazine and newspapers are relatively more descriptive and understandable than the information distributed in other information sources. In 1970, Nelson made a clear distinction between search and experience goods in his well-known publication, *Information and Consumer Behavior*. He defined a search good as a good which its quality can be assessed prior to the purchase and an experience good as a good that its quality can be defined only after the consumption. In addition, Nelson (1970, 1974) demonstrated an informative role of advertising. He claimed that advertising also provides a lot of indirect information to the consumers of experience goods. According to Nelson's definitions, gluten-free products can be defined as experience goods. Therefore, when a customer encounters different information from various sources about a gluten-free diet, she has to process all the associated indirect information about gluten-free products. When a customer mainly received her information about a gluten-free diet through reading magazine and newspapers, she would have enough time and descriptive details to process the learning of all these indirect information which she received from advertising. This enables her to have a better understanding of a gluten-free diet, which affects her decisions of following the diet. Although we did not initiate any hypotheses regarding to an individual's information sources previously, the findings in Table 3 & Table 4 exhibit great sources that could influence a consumer's choice preferences towards gluten-free products.

Table 5 contains the results of how an individual of non-CD or non-NCGS community decides to follow a gluten-free diet is affected by her observation of her community's food consuming behaviors. The results are given under Model 3 (the willingness to follow a gluten-free diet after observing herds' food consuming behaviors towards gluten-free products). According to the results, we recognize that observing community's food behaviors has a positive impact on an individual's decisions of following a gluten-free diet. Individuals who observed celebrities and politicians following a

gluten-free diet are more motivated to follow a gluten-free diet afterwards. They are also more apt to follow the diet after observing close friends or family members following a gluten-free diet. These positive effects are tested significantly different from 0. This conforms to our expectations as consumers exhibit higher willingness to follow a gluten-free diet after they observed their communities following the diet. As we have indicated in the perspective of herd behavior, an individual could take her community's decision of following a gluten-free diet as her own without factoring in her own particular information if she is experiencing the herd behavior. Because of this, during the process of deciding to follow a gluten-free diet, consumers could experience the herd behavior in their final decisions after observing their communities' food behaviors. Overall, the findings we have are supportive to our hypotheses **H7**.

At the end, we have the analysis of how following a gluten-free diet can affect an individual's future consuming behavior towards other food products. In this case, the test subjects in this experiment of non-CD or non-NCGS community were divided into two groups, group A<sup>6</sup> and group B<sup>7</sup>. We measured the participants' responses towards a vitamin A<sub>e</sub>-free diet within each group<sup>8</sup>. The means of group A's responses in each question are presented in the second column of Table 6. Likewise, we calculated the means of the participants' response in group B for the same questions. The results are included in the third column of the table. In addition, we calculated the mean difference between group A's responses and group B's responses for each given question in the table. We measured the statistic significance<sup>9</sup> of these mean

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<sup>6</sup>The consumers in group A are following a gluten-free diet.

<sup>7</sup>The consumers in group B are not following a gluten-free diet.

<sup>8</sup>The selected questions of the survey for this particular research purpose are presented in the first column of Table 6. Each survey participant answered these questions from 0 to 10. 0 means the individual strongly disagrees with the question's statement and 10 means the individual strongly agrees with the question's statement. You can check Survey A in the appendix for any further references.

<sup>9</sup>\* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

differences through calculating the associated  $P$  values. The identified results of the significance are shown in the last column. According to all of our results, we find that group A is much more willing to follow or recommend a vitamin Ae+-free diet than group B. The calculated mean differences are tested significantly different from 0. This indicates that an individual of non-CD or non-NCGS who follows a gluten-free diet is more apt to follow or recommend a vitamin Ae+-free diet than an individual who does not. As we have introduced in our surveys previously, the information of vitamin Ae+ and SugarDev included in the vitamin Ae+'s reading passages were completely made-up. Therefore, following a gluten-free diet demonstrates a positive influence in encouraging a consumer to follow a brand new food diet. Furthermore, we recognize that the consumers who follow a gluten-free diet tend to have a stronger positive belief about a vitamin Ae+-free diet. According to the results presented in the third, fourth, fifth and sixth rows<sup>10</sup> of the table, group A's mean response in each question is higher than group B. In the same rows, we identify that three of these four mean differences are tested significantly different from 0. All of these imply that following a gluten-free diet positively motivates consumers to form positive beliefs about a brand new food diet.

There are two additional results of Table 6 stand out with respect to a consumer's willingness to follow a vitamin Ae+-free diet (WTFV) after observing her community's food consuming behavior and the social approval regarding her food consumption. First, we observe group A's mean response regarding WTFV after observing each given herd's food consuming behavior is higher than group B. This observation (7th row) implies that a consumer who follows a gluten-free diet could experience a stronger impact of herd behavior while she is deciding to follow a brand new food

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<sup>10</sup>The table's first column of these four rows includes positive beliefs about a vitamin Ae+-free diet. However, these four beliefs are completely made-up for our research purposes.

diet after she observed her community's food consuming behavior. Second, the results in last two rows of the table show that group A demonstrates a higher desire of non-monetary social approval than group B when they are following a vitamin Ae+-free diet. The mean differences of these two are tested significantly different from 0. Based on this, we can conclude that consumers who follow a gluten-free diet care more about their peers' social approval than consumers who do not in following a brand new food diet. However, how social approval from peers actually affects an individual of non-CD or non-NCGS to follow a gluten-free diet and her future food consuming behaviors remains unclear. This requires further studies. Overall, following a gluten-free diet demonstrates an encouraging role that motivates consumers to follow and accept a brand new food diet. This is completely against to our previous hypothesis. As we stated previously, an individual depends on her inside information of personal characteristics and the outside information of a gluten-free diet that she collected to make her decisions of following the diet. When she is considering following another food diet or not, she would recollect outside information of this particular food product and combine this new information with her personal characteristics to place her final decisions. Intuitively, because a vitamin Ae+-free diet has few noticeable similarities with a gluten-free diet, following a gluten-free diet should be independent to the consumer's future decisions of following a vitamin Ae+-free diet. However, all the results shown in Table 6 do not conform to our expectations. Indeed, we have no evidence to support our hypothesis **H8**. The possible explanations of this interesting abnormality remain unclear and need further studies.

## Chapter IV

### CONCLUSION

Our main results are summarized as follows. First, consumers in the experiment exhibited higher willingness to follow a gluten-free diet when the information of the diet they received is positive. The result implies that having positive information would encourage an individual to follow a gluten-free diet. Additionally, we found no evidence to claim that an individual's decisions of following a gluten-free diet would be affected by providing negative information of the diet. Second, in the experiment, we cannot observe any obvious evidence to demonstrate that consumers' willingness to follow a gluten-free diet would be affected by their income or education levels. However, they revealed lower willingness to follow a brand new food diet if they are heavily uneducated. This implies that one's education level could have an impact on her future decisions of food consumption. Third, we observed that consumers who are unfamiliar with CD showed a higher willingness to follow a gluten-free diet; but, this relationship is not applied to the case when consumers are unfamiliar with a gluten-free diet in the experiment. Consumers who have a higher self-evaluation of their daily diets' health level also presented a stronger willingness to follow a gluten-free diet. Furthermore, in the experiment, we observed that not having family members following a gluten-free diet would significantly discourage consumers to follow the diet. Fourth, we first observed a negative impact on the willingness of following a brand new food diet from being a female. This indicates that females are less willing to follow a brand new food diet than males; but this relationship is not applied to consumers' choice preferences towards gluten-free products. Instead, we found that consumers who mainly received their information about gluten-free products from magazine and

newspapers demonstrated a higher willingness to follow a gluten-free diet. The result implies that where an individual mainly receives her information about a gluten-free diet actually matters. Fifth, when consumers are allowed to observe their herds' food consuming behaviors, they adjust their choice preferences towards gluten-free products. In the experiment, consumers who observed celebrities and politicians following a gluten-free diet are more motivated to follow a gluten-free diet afterwards. They are also more apt to follow the diet after observing close friends or family members following a gluten-free diet. All of these findings demonstrate great sources that could affect a consumer's choice preferences of following a gluten-free diet for our research purposes. Lastly, this study investigates how following a gluten-free diet can affect an individual's future consuming behavior towards other food products. We identified that consumers who follow a gluten-free diet are more apt to follow or recommend a brand new food diet than consumers who does not in the experiment. They also tend to have a stronger positive belief about a brand new food diet. Furthermore, in the experiment, consumers who follow a gluten-free diet could experience a stronger impact of potential herd behavior while they are making their decisions of following a brand new food diet. They also demonstrated a higher need of non-monetary social approval in their future food purchasing decisions. Overall, following a gluten-free diet demonstrates an encouraging role that motivates consumers to follow and accept brand new food products.

Our research suggests two possible directions for any further studies. First, the effects of having different types of information on a consumer's decisions of following a gluten-free diet are not significant. In the experiment, consumers exhibited noticeable higher/lower willingness to follow a brand new food diet when they are provided positive/negative information. However, we only observed positive information imposed a weak encouraging impact on a consumer's willingness to follow a gluten-free

diet. Therefore, a further understanding of the diminishing effects of information on an individual's decisions of following a gluten-free diet should be encouraged. Second, the reasons of consumers who following a gluten-free diet demonstrated a higher willingness to follow and accept brand new food products are ambiguous. As we have explained previously, if the given brand new food diet has few similarities with a gluten-free diet, a consumer's future decisions of following this diet should be independent to the behavior of following a gluten-free diet. However, all the results we discovered in the experiment do not conform to our intuitions. Hence, we believe that conducting a rigorous research and experiment of analyzing how an individual's gluten-free diet following behavior is correlated to her future food consumptions would be necessary and important.

## APPENDIX

### Survey A

#### *Section 1*

Vitamin Ae+ is a newly discovered vitamin that exists in many of our daily diets such as milk, rice and orange juice. It can be removed from food through a new technology called Filter-V. Vitamin Ae+-free products are getting increasingly popular nowadays. Do you think having a vitamin Ae+-free diet is healthier? Around twenty-two percent of the population does. Most research indicates that vitamin Ae+-free diet is safe, and can be healthy for everyone. The diet alleviates many symptoms, including cough, weight loss and fatigue.

**Q1.** Twenty-two percent of the population is a fairly big number. Yes/No

**Q2.** How do you view the following beliefs about a vitamin Ae+-free diet (on a scale from 0-10<sup>1</sup>)?

A vitamin Ae+-free diet helps in relieving fatigue.

Vitamin Ae+-free products have fewer calories than regular products.

A vitamin Ae+-free diet is more nutritious.

A vitamin Ae+-free diet is healthy for you. You should cut out vitamin Ae+ in your daily meals.

**Q3.** On a scale from 0-10, you would likely follow a vitamin Ae+-free diet if you were given a chance right now.

**Q4.** On a scale from 0-10, you would likely recommend others follow a vitamin Ae+-free diet if you were given a chance right now.

**Q5.** From what you read, you see a lot of people are following a vitamin Ae+-free diet. On a scale from 0-10, you would also consider following a vitamin Ae+-free diet.

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<sup>1</sup>0 means totally disagree, 5 means neither agree or disagree and 10 means totally agree.

**Q6.** From what you read, you see a lot of celebrities and politicians are following a vitamin A<sub>e</sub>-free diet. On a scale from 0-10, you would also consider following a vitamin A<sub>e</sub>-free diet.

**Q7.** In your daily life, you see a lot of your close friends and family members are following a vitamin A<sub>e</sub>-free diet. On a scale from 0-10, you also would consider following a vitamin A<sub>e</sub>-free diet.

**Q8.** On a scale from 0-10, it is important for you that your community knows that you are following a vitamin A<sub>e</sub>-free diet.

**Q9.** On a scale from 0-10, it is important for you that your community knows that you are recommending others to follow a vitamin A<sub>e</sub>-free diet.

## ***Section 2***

**Q10.** What is your gender? Male/Female

**Q11.** What is your age?

18-25/26-30/31-35/36-40/41-50/51-60/60+

**Q12.** What is your yearly income level?

Less than \$35,000/\$35,001 to \$50,000/\$50,001 to \$75,000/\$75,001 to \$100,000/\$100,001 to \$150,000/\$150,001+

**Q13.** What is your education level?

Graduate degree and above/College degree/High school/Less than high school

**Q14.** Are you familiar with celiac disease? Yes/No

**Q15.** Are you familiar with a gluten-free diet? Yes/No

**Q16.** Do you currently follow a gluten free diet? Yes/No

**Q17.** Does anyone in your family follow a gluten-free diet? Yes/No

**Q18.** On a scale from 0-10, how healthy do you think your family is eating?

**Q19.** Where do you get the majority of your information about a gluten-free diet?

Family and friends/Internet or Online/Licensed health professionals/Government agency reports/TVs/Magazine and newspapers/Food Package labels/Others

**Q20.** How do you view the following beliefs about a gluten-free diet (on a scale from 0-10)?

A gluten-free diet helps in weight loss.

Gluten-free products have fewer calories than regular products.

A gluten-free diet is more nutritious.

A gluten-free diet is healthy for you. You should cut out grains in your daily meals.

**Q21.** On a scale from 0-10, you would likely follow a gluten-free diet if you were given a chance right now.

**Q22.** On a scale from 0-10, you would likely recommend others follow a gluten-free diet if you were given a chance right now.

**Q23.** From what you read, you see a lot of people are following a gluten-free diet. On a scale from 0-10, you would also consider following a gluten-free diet.

**Q24.** From what you read, you see a lot of celebrities and politicians are following a gluten-free diet. On a scale from 0-10, you would also consider following a gluten-free diet.

**Q25.** In your daily life, you see a lot of your close friends and family members are following a gluten-free diet. On a scale from 0-10, you would also consider following a gluten-free diet.

**Q26.** On a scale from 0-10, it is important for you that your community knows that you are following a gluten-free diet.

**Q27.** On a scale from 0-10, it is important for you that your community knows that you are recommending others to follow a gluten-free diet.

**Q28.** When was your last time to seek out any gluten-free products?

Within last week/Within last two weeks/Within last three weeks/Within last month/Longer than a month/Never

**Q29.** How much extra you are willing to pay for a gluten-free product?

0-2%/2-5%/5-10%/10-15%/15-25%/25-35%/35-45%/45%+

**Q30.** Do you have celiac disease? Yes/No

### ***Section 3***

Do you think having a gluten-free diet is healthier? Thirty percent of the population does. But actually it might not help at all. Most research does not indicate that gluten is bad for you unless you have a rare disease called celiac disease, but that only occurs in one percent of the population. For the vast majority of people, gluten-free does not mean healthy.

**Q31.** You have heard having a gluten-free diet is healthier. Yes/No

**Q32.** How do you view the following beliefs about a gluten-free diet (on a scale from 0-10)?

A gluten-free diet helps in weight loss.

Gluten-free products have fewer calories than regular products.

A gluten-free diet is more nutritious.

A gluten-free diet is healthy for you. You should cut out grains in your daily meals.

**Q33.** On a scale from 0-10, you would likely follow a gluten-free diet if you were given a chance right now.

**Q34.** On a scale from 0-10, you would likely recommend others follow a gluten-free diet if you were given a chance right now.

**Q35.** From what you read, you see a lot of people are following a gluten-free diet. On a scale from 0-10, you would also consider following a gluten-free diet.

**Q36.** From what you read, you see a lot of celebrities and politicians are following a gluten-free diet. On a scale from 0-10, you would also consider following a gluten-free diet.

**Q37.** In your daily life, you see a lot of your close friends and family members are following a gluten-free diet. On a scale from 0-10, you would also consider following a gluten-free diet.

**Q38.** On a scale from 0-10, it is important for you that your community knows that you are following a gluten-free diet.

**Q39.** On a scale from 0-10, it is important for you that your community knows that you are recommending others to follow a gluten-free diet.

**Table 1:** Potential factors that affect a consumer's choice preferences-part 1

Variables	Model 2	Model 1
<b><i>Vitamin Ae+-free diet information</i></b>		
VitGood	0.707** (0.307)	0.538* (0.301)
VitBad	-0.812*** (0.287)	-0.231 (0.326)
<b><i>Gluten-free diet information</i></b>		
GlutGood	-0.330 (0.287)	0.623* (0.319)
GlutBad	-0.252 (0.318)	-0.229 (0.321)
<b><i>Income level</i></b>		
\$35,001 to \$50,000	0.202 (0.277)	0.383 (0.282)
\$50,001 to \$75,000	-0.0933 (0.292)	0.109 (0.312)
\$75,001 to \$100,000	-0.0621 (0.487)	0.0698 (0.423)
\$100,001 to \$150,000	-0.728* (0.433)	0.159 (0.671)
\$150,001+	0.740 (0.582)	0.372 (0.991)
<b><i>Education level</i></b>		
College degree	-0.198 (0.327)	-0.585 (0.383)
High school	-0.0697 (0.369)	-0.781* (0.403)
Less than high school	-2.343*** (0.542)	-1.259 (1.049)

**Table 2:** Table 1 (continued)

<b><i>Familiarity with CD and GFD</i></b>		
Not familiar with celiac disease	0.707*** (0.234)	1.086*** (0.251)
Not familiar with a gluten-free diet	0.898 (0.556)	0.000861 (0.502)
No one in your family follows a gluten-free diet	-0.0110 (0.364)	-1.282*** (0.387)
Self-evaluated level of healthy diet	0.132** (0.0596)	0.166*** (0.0593)
Observations	590	592
Pseudo $R^2$	0.2657	0.1273

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Note1: Model 2 is the willingness to follow a vitamin Ae+-free diet (WTFV).

Note2: Model 1 is the willingness to follow a gluten-free diet (WTFG).

Note3: CD stands for celiac disease and GFD stands for gluten-free diet.

**Table 3:** Potential factors that affect a consumer's choice preferences-part 2

Variables	Model 2	Model 1
<b><i>Gender</i></b>		
Female	-0.383* (0.220)	0.205 (0.222)
<b><i>Information sources</i></b>		
Internet/Online	-0.141 (0.343)	-0.361 (0.344)
Licensed health professionals	-0.705 (0.484)	-0.251 (0.624)
Government agency reports	-0.0230 (1.115)	-0.423 (0.970)
TVs	-0.345 (0.589)	-0.586 (0.530)
Magazine and newspapers	-0.700 (0.583)	-1.956*** (0.443)
Food Package labels	-0.459 (0.807)	-0.152 (1.189)
Others	-0.429 (0.727)	0.540 (1.008)

**Table 4:** Table 3 (continued)

<i>Frequency to seek out any gluten-free products</i>		
Within last two weeks	0.213 (0.768)	–
Within last three weeks	3.191*** (0.669)	–
Within last month	-0.0440 (0.734)	–
Longer than a month	0.0909 (0.653)	–
Never	-0.484 (0.663)	–
<i>Willingness to pay extra for a gluten-free product</i>		
2-5%	1.242*** (0.421)	–
5-10%	1.395*** (0.445)	–
10-15%	1.736** (0.777)	–
15-25%	0.672 (0.765)	–
25-35%	-1.431 (1.494)	–
45%+	8.758*** (0.889)	–
Observations	590	592
Pseudo $R^2$	0.2657	0.1273

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**Table 5:** Potential factors that affect a consumer's choice preferences-part 3

Variables	Model 3
WTFG (after observing celebrities and politicians)	0.470*** (0.0535)
WTFG (after observing close friends and family members)	0.500*** (0.0505)
Observations	582
Pseudo $R^2$	0.7875

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Note: Model 3 is the willingness to follow a gluten-free diet (WTFG).

**Table 6:** Comparison-a consumer's choice preferences

	(A)	(B)	(A-B)
	Mean	Mean	Mean difference is > 0
Willingness to follow a vitamin Ae+-free diet	4.000	2.669	***
Willingness to recommend a vitamin Ae+-free diet	3.714	2.322	***
A vitamin Ae+-free diet helps in relieving fatigue	5.893	4.970	**
Vitamin Ae+-free products have fewer calories than regular products	5.179	4.650	Insignificant
A vitamin Ae+-free diet is more nutritious	5.286	4.421	**
A vitamin Ae+-free diet is healthy for you, you should cut out vitamin Ae+ in your daily meals	5.607	4.429	**
WTFV (after observing random people)	4.286	2.721	***
WTFV (after observing celebrities and politicians)	3.857	2.336	***
WTFV (after observing close friends and family members)	3.893	3.370	Insignificant
It is important that your community knows that you are following a vitamin Ae+-free diet	2.929	1.450	***
It is important that your community knows that you are recommending others to follow a vitamin Ae+-fee diet	2.750	1.488	***
Observations	28	571-576	—

Standard errors in parentheses

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Note1: group A is following a gluten-free diet and group B is not following a gluten-free diet.

Note2: all the entries of the table are the means of each group's responses in the given survey question.

Note3: each participant answered the questions from 0 to 10. 0 means strongly disagree and 10 means strongly agree.

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