COLLEGE STUDENTS’ PERCEPTIONS OF AND ATTITUDES TOWARD PROBIOTICS AND PROBIOTIC FOOD PRODUCTS

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by

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DEDICATION

This thesis is dedicated to my husband, Jamal, for his love, endless support and encouragement since the beginning of my studies. Also, this thesis is dedicated to all those who believe in the importance of learning.
ACKNOWLEDGMENT

I would like to thank all of the people who have helped and inspired me during my thesis study. A special thanks goes to my chair, Dr. Chowa, for her insight and guidance during my research. Dr. Plunkett, Mrs. Besnilian, and Dr. Fajardo deserve special thanks as my thesis committee members and advisors. In particular, I would like to thank Dr. Plunkett for his perpetual energy and enthusiasm in research which motivates all his advisees, including myself. Also, I would like to thank Dr. Williams and Mrs. Esfarjani for providing their students a source for my data. My deepest gratitude goes to my family for their love and support throughout my life; this thesis is simply impossible without them.
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ABSTRACT

COLLEGE STUDENTS’ PERCEPTIONS OF AND ATTITUDES TOWARD PROBIOTICS AND PROBIOTIC FOOD PRODUCTS

by

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Master of Science in Family and Consumer Sciences

The aim of this study was to determine the perception of and attitude toward probiotic food products among college students. This study used a self-report survey with a convenience sample of 304 of students from upper- and lower-division classes at CSUN. Data were collected in November 2011 and analyzed with t-tests, Chi Squares, and bivariate correlations. The results of this study indicated no significant differences between men and women on (1) how often they consume probiotic foods and (2) how much they know about probiotic food products. In addition, there were no significant differences between men and women on how they defined probiotic food products. Almost half of the participants could not answer the question, “How would you define probiotic food products?” The results also indicated that as participants’ age, they are significantly more likely to consume probiotic food products ($r = .21, p < .01$) and hear about probiotic food products ($r = .17, p < .01$). However, no significant correlation was found between income and consumption of or hearing about probiotic food products. In conclusion, the results indicated a lack of knowledge about probiotic functional food products among the general public, even among educated consumers such as college students. Therefore, it is necessary to make more of an effort to educate the public about
probiotic functional food products; there should be more studies to not only educate the public but also further investigate the benefits of these products.
CHAPTER I
INTRODUCTION

For years, food was simply a way to satisfy hunger and obtain enough nutrients to fulfill the metabolic requirement for one’s overall well-being, but today, scientists believe that in addition to these two benefits, diet may also play a beneficial role in improving health and even preventing diseases. In the early 1980s, Japan became the pioneer researcher in the development of functional foods (Roberfroid, 2000). The government of Japan funded and supported scientific research on a large scale regarding functional foods to enhance human health and thus reduce the increasing cost of healthcare. In 1991, Japan established a regulation for functional foods to be introduced to the public to improve health.

No simple definition of “functional food” exists, but a general consensus would postulate that functional foods are a category of food that results from using technology or biotechnology to add, eliminate, alter, or raise the concentration of a component of a food (Roberfroid, 2000). Functional foods improve the body’s physiological and mental functions and also prevent diseases or abnormal functions in the body. In general, functional foods are defined as healthy foods with health-promoting and/or disease-preventing properties beyond the traditional and basic nutrients such as vitamins and minerals (Menard, 2003). The concept of a functional food is not to remove harmful components but rather to add a beneficial component to the diet (Azizpour, Bahrambeygi, Mahmoodpour, & Azizpour, 2009).

One of the major components of functional foods is probiotics. Probiotic products existed in European and Asian markets for a couple of decades but just recently were
recognized and consumed by the public in the United States (Ranganathan et al., 2010). In the United States, they gradually are becoming part of many American diets in the shape of beverages, supplements, dairy products (e.g., yogurt, kefir, cheese), and some fermented foods.

The official definition of “probiotics” is given by the United Nation’s Food and Agricultural Organization (FAO) and the World Health Organization (WHO). These organizations define probiotics as “live microorganisms which, when administered in an adequate amount, confer a beneficial health effect on the host” (Food and Agricultural Organization, 2002).

The concept of probiotics originated from and was developed by Elie Metchnikoff in 1908 (Azizpour et al., 2009). Metchnikoff observed that Bulgarian peasants who consumed fermented milk foods lived longer than those who did not. He developed a theory that lactobacilli might replace or diminish the toxic bacteria residing in the gut. Inspired by Metchnikoff’s theory, in 1930, a Japanese microbiologist, Minoru Shirota, and other researchers acknowledged the significance of probiotics and their beneficial effects in preventing diseases and modifying the gastrointestinal microflora. In the 1930s and late 1950s, research in this area almost came to a halt due to the Great Depression and World War II. However, probiotics development was again rejuvenated in the early 1960s and followed by the introduction of the probiotics concept.

**Statement of Problem**

The rising cost of health care, an aging population, recent advances in medicine and life sciences, and the risk of diseases cause people to think differently about the food they consume. As a result, new kinds of functional foods provide an important
opportunity and enormous market possibilities for food manufacturing industries to
develop new health and nutrition-related products (Niva & Mäkelä, 2005). Probiotic food
products such as yogurt and other fermented milk products are considered the first
functional and most-important members of the new food products (Azizpour et al., 2009).
Unfortunately, due to the lack of public knowledge and awareness about the benefits of
probiotic food products, these health-enhancing foods are underutilized. General
consumer attitudes toward and perceptions of the new food products, which contain many
health benefits, are important to the food manufacturers (Stanczak & Heuberger, 2009).
There is substantial evidence of the many health benefits attributed to probiotic food
products, such as treating gastrointestinal disease (e.g., Ulcerative Colitis, Crohn’s
disease), improving the immune system, lowering cholesterol levels, treating alcoholic
liver disease, treating children with lactose malabsorption, and reducing urinary tract
infection (Arunachalam, Gill, & Chandra, 2000; de Vrese et al., 2001; Haller et al., 2010;
Kirpich et al., 2008; Kruis et al., 2004; Pereira, McCartney, & Gibson, 2003;
Rampengan, Manoppo, & Warouw, 2010; Sheth, Parnami, & Bhumra, 2007; Uehara et
al., 2006). It is important to make the public more aware of the health benefits of
probiotic food products.

**Purpose**

The purpose of this research is to determine the perceptions of and attitudes
toward probiotic food products among college students. Gender differences will be
examined as well as relationship between age and income and probiotic food products.
The results of this thesis could be potentially beneficial to food manufacturers and
marketers. In addition, registered dietitians, physicians, and other health practitioners who work with university students could also potentially benefit from this thesis.

**Research Question**

What attitudes toward and perceptions of probiotic food products do college students possess? What is the relationship between students’ perception toward probiotics and their gender, age and incomes?

**Justification**

Today’s college students represent a generation who, as they age, may be at risk for developing multiple chronic diseases. Measuring the knowledge of probiotics among college students may help provide a foundation for a valuable marketing strategy for probiotic food products, which may help prevent and treat some chronic diseases. According to Armstrong, Farley, Gray, and Durkin (2005), if an educational strategy can be developed along with a marketing strategy, it may be possible to help treat or prevent certain diseases.

**Definitions**

**B-Galactosidase:** An enzyme that breaks down lactose to galactose and glucose (Singleton & Sainsbury, 2006).

**Bifidobacterium:** A genus of gram-positive, anaerobic, asporogenous, bacteria which reside among the vaginal and gastrointestinal tract flora (Singleton & Sainsbury, 2006).

**Crohn’s disease:** A chronic inflammatory bowel disease in the small and large intestines (Hecht & Shiel, 2003).

**Escherichia coli:** A gram-negative bacteria (Singleton & Sainsbury, 2006).
**FAO:** “Food and Agriculture Organization of the United Nations” (Bender, 2006, p. 181).

**Functional foods:** Foods that contain nutrient or non-nutrient substances that provide more health-promoting elements than do those foods offering basic nutritional benefits (Bender, 2006).

**IBD:** A chronic intestinal disease that causes inflammation in small and large intestines (Hecht & Shiel, 2003).

**Interferon:** Proteins normally produced by the body in reaction to infection (Hecht & Shiel, 2003).

**Lactic acid bacteria (LAB):** Gram-positive bacteria that perform the lactic acid fermentation of sugars (Singleton & Sainsbury, 2006).

**Lactobacillus:** A genus of rod-shaped, gram-positive asporogenous bacteria (Singleton & Sainsbury, 2006).

**Lactose:** A disaccharide in milk that splits into glucose and galactose (Singleton & Sainsbury, 2006).

**Microbiota:** Microscopic organisms that predominantly live in soil (Singleton & Sainsbury, 2006).

**Microflora:** A combination of microorganisms and other bacteria living together in an environment (Singleton & Sainsbury, 2006).

**Monosodium glutamate (MSG):** Flavor enhancer (Bender, 2006).

**Phagocyte:** Cells like neutrophils and monocytes that are able to engulf other microorganisms, bacteria, and foreign materials (Hecht & Shiel, 2003).

**Poi:** Polynesian paste food made from a taro plant (Bender, 2006).
Polymorphonuclear: A form of white blood cell likely to possess multiple nuclei (Hecht & Shiel, 2003).

Prebiotics: Non-digestible oligosaccharides, such as galactose and fructose, that help the growth of specific bacteria in the colon (Bender, 2006).

Probiotics: Substance in some foods, such as dairy fermented products, that helps the growth of helpful bacteria in the gastrointestinal tract (Hecht & Shiel, 2003).

Ulcerative colitis: An inflammatory disease in the large intestine (Hecht & Shiel, 2003).

UTI: “Urinary tract infection” (Hecht & Shiel, 2003, p. 418).


Null Hypotheses

• Hypothesis 1: There is no significant difference between male and female college students in their perceptions of probiotic food products.

• Hypothesis 2: There is no significant correlation between college students’ ages and their perceptions of probiotic food products.

• Hypothesis 3: There is no significant correlation between college students’ incomes and their perceptions about probiotic food products.

Assumptions

• Participants were able to read and understand questions and instructions.

• Participants answered the questions honestly.

• Participants were not influenced or contacted by researchers during the study.

• The data were entered and analyzed without errors.
Limitations

- This sample population is limited to students at California State University Northridge, which limits the ability to generalize the results.

- The data were obtained by a cross-sectional study design through self-report surveys, thus assertions of causality cannot be made and the relationships between variables may be inflated due to shared method variance.

- Answers may not be accurate because the survey was completed during class periods and students may have been rushed to answer the questions.
CHAPTER II
REVIEW OF LITERATURE

The increasing aging population, growing health consciousness, and recent technological advances in the United States and Europe result in steadily rising health care costs (Goyen & Debatin, 2009). Rising health care costs and advances in science and technology provide an important opportunity and enormous market for food manufacturing industries to develop new healthy and nutritional products such as functional foods (Niva & Mäkelä, 2007).

A long history of safe use has established the bioactive components from probiotics and fermented foods as the predominantly used functional compounds (Azizpour et al., 2009). Some studies point towards the benefits of probiotics; however, due to different strain usage, levels of consumption, and duration of dietary interventions, the results are inconsistent. To obtain more consistent and reliable results, researchers are establishing an identified strain and determining the amount and frequency of consumption of probiotic products as a requisite for all future studies (Bruhn et al., 2002).

Health Benefits

Some individuals consider probiotic foods beneficial only to those facing high health risks, such as people with a family history of disease, individuals with unhealthy lifestyles, or the elderly (Bruhn et al., 2002). However, the results of the majority of studies about probiotics indicate that while the main effect of the probiotic food products on the intestinal tract is well known, the health benefits of probiotics extend far beyond (Lenoir-Wijinkoop et al., 2007).
Historically, probiotics were used for treating health problems such as gastrointestinal diseases or intestinal inflammatory bowel diseases (e.g., Crohn’s disease and ulcerative colitis) and improving immune function, lactase digestion, hyperlipidemia, hepatic diseases, and genitourinary tract infections (Brown, Shovic, Ibrahim, Holck, & Huang, 2005). In addition to the health benefits of fermented dairy probiotic food products (e.g., probiotics yogurt), non-dairy probiotics such as poi (a common food in islands of the Pacific) also offer potential benefits for people with allergies and can be used as a nutritional source for patients with weight loss problems (Brown et al., 2005).

**Gastrointestinal Diseases**

Most studies conducted on probiotic food products are used for treating gastrointestinal disorders (Sheth et al., 2007). Gastrointestinal microbiota are essential and contain both harmful and beneficial microorganisms. Because there are up to 400 different species, balancing the harmful and the beneficial microorganisms in the gastrointestinal system is essential for the well-being and health of consumers. These microorganisms can be influenced by diet, age, race, stress, medication, and environment. Adding beneficial bacteria such as prebiotic and probiotic foods is now of great interest to the scientific community and public alike. *Lactobacilli* and *bifidobacteria* are two important groups of microorganisms shown to be beneficial to human health (Sheth et al., 2007).

The consumption of prebiotic and probiotic food products adds beneficial bacteria to the human gut such as *Bifidobacteria* and *Lactic acid bacteria* and reduces pathogenetic microorganisms like *E.coli* from the human gut (Sheth et al., 2007).
**IBD Diseases**

One of the main gastrointestinal tract disorders is chronic inflammatory bowel disease (IBD) (Haller et al., 2010). Many studies on human and animal models with IBD indicated that bacteria in the gastrointestinal tract are the main factors contributing to the development of treatments for the prevention of chronic IBD. Two major IBD gastrointestinal tract diseases are *Ulcerative colitis* and Crohn’s disease. The occurrence of Crohn’s disease is on the rise in Western countries, and this increase prompted studies looking for a therapeutic approach with rare side effects. None of the probiotics strains were effective in the treatment of Crohn’s disease (Haller et al., 2010). On the other hand, the probiotics *Escherichia coli* Nissle 1917 (EcN) offered therapeutic effects for *Ulcerative colitis* remission (Kruis et al., 2004).

**Improving the Immune System**

Lactic acid bacteria (LAB) are the most common microflora residing in the human large intestine (Arunachalam et al., 2000). *Lactobacilli* and *bifidobacteria* are the two most common strains of LAB found in most fermented foods. They are primarily found in dairy products such as yogurts and cheeses. The laboratory-based trials conducted on animals and humans indicated that probiotics bacteria such as LAB enhance and improve natural immune function.

The dietary *Bifidobacterium Lactis* HN019, which is frequently used as a probiotics, can be quite beneficial for natural immune function among healthy older subjects (Arunachalam et al., 2000). In addition, the LAB strain known as *B. Lactis* HN019 particularly increased the secretion of Interferon-alpha (IFNα) by mononuclear and improved phagocyte ability of polymorphonuclear (PMN) cells.
Lowering Cholesterol

Cholesterol-lowering properties are another potential benefit of probiotics (Pereira et al., 2003). LAB were shown to lower cholesterol through deconjugation of bile acids, which reduces serum cholesterol and requires more cholesterol for synthesis. In turn, this causes bile acid to decrease the solubility of cholesterol and its absorption through the intestinal lumen. *Lactobacillus fermentum* KC5b is a type of LAB that will affect cholesterol metabolism.

Alcoholic Liver Disease

Alcoholic liver disease (ALD) is the major cause of morbidity and mortality in the United States and around the world (Kirpich et al., 2008). Liver diseases can be caused by alternation of bowel flora. A probiotics preparation containing *Bifidobacterium bifidum* and *Lactobacillus plantarum 8PA3* can be a short-term treatment for alcoholic-induced liver injury. This treatment works by restoring the bowel flora to its natural state.

Lactose Malabsorption

Excluding northern and central Europe and offspring living in the United States and Australia, 70–100% of the world’s population suffers from lactose malabsorption (de Verse et al., 2001). Lactose malabsorption can result in not having enough of the β-galactosidase enzyme, which breaks down lactose in the brush boarder of the intestinal mucosa. This deficiency in lactase activity in the small intestine disrupts digestion of the lactose and is called “lactose malabsorption” or “lactose maldigestion”. The results from the study that utilized the breath hydrogen test (BHT) indicated that consuming live and dead probiotics for two weeks was effective for treating children with lactose malabsorption (Rampengan et al., 2010).
Recurrence of Urinary Tract Infection

The idea that exogenous *Lactobacillus* can maintain optimal vaginal microflora is a century-old idea (Uehara et al., 2006). The female urogenital tract can be protected from pathogen colonization by vaginal *lactobacillus*, and as a result, it can be an important component for prevention of urinary tract infection. Administering vaginal suppositories including *Lactobacillus crispatus* GAI 98332 may possibly prevent the recurrence of urinary tract infection (UTI).

Perception of Probiotic Food Products

The objective of the study by Viana, da Cruz, Zoellner, Silva, and Bastista (2008) was to evaluate the perception of and attitude toward probiotic food products in Rio de Janeiro, Brazil. The results demonstrated confusion among participants in understanding the differences between probiotic food products and diet or light foods available in the market. Based on the results of a study by Viana et al. (2008), to increase consumers’ positive perceptions of and attitudes toward probiotic food products, the public must be educated about the benefits. The main factor in educating the public would be to make information readily accessible and clear to consumers.

The results from a study conducted by Jezewska-Zychowicz (2009) about the effect of attitudes toward and beliefs about the willingness of young consumers to use functional food showed that respondents were familiar with these products, particularly probiotics yogurt, due to frequent use. The students’ responses indicated a willingness to use functional foods. Their willingness related to their attitude toward the health benefits of consuming specific functional foods, mainly probiotics yogurt and cholesterol-lowering spreads. Analysis of this study indicated that elements such as need, positive
attitude toward health, and safety significantly influenced decisions to use functional foods. Moreover, educating consumers helped develop a more-positive attitude toward health-enhancing foods in general.

Most consumers read the nutritional information on the probiotic food products’ labels if they are purchasing them for the first time (Bruhn et al., 2002). Some consumers check the label only when they are looking for specific health benefits. Others notice only statements such as “cholesterol free,” “no MSG,” or “fat free” and any statements regarding heart health as long as they were endorsed by a credible health organization such as the American Heart Association. Awareness of and familiarity with probiotic food products and the specific probiotics strains (e.g., *Lactobacillus* and *Bifidobacterium*) and their health benefits varied among people from knowledgeable to unaware and from trusting to not believing (Bruhn et al., 2002). Additionally, results from the study conducted by McConnon, Fletcher, Cade, Greenwood, and Pearman (2004) indicated that a lack of consumer trust in manufacturers and the government for controlling functional food labeling resulted in concern about the credibility of labeling for these new food products.

Frequently, the focus group study technique is used to gather data on functional food consumption and its association with consumer attitudes and opinions. In a focus group study conducted by Barrios, Bayarri, Carbonell, Izquierdo, and Costell (2008), the majority of participants acknowledged that even if they had a positive opinion toward probiotic food products such as fermented dairy products or yogurts, they still held doubts about the other functional food products such as milk supplemented with calcium. Participants also identified factors such as price, lack of knowledge concerning
ingredients, and uncertain physiological effects as reasons for doubt and hesitation
toward purchasing functional food products.

The outcome of the study by McConnon et al. (2004) showed that the participants
believed that scientists knew a great deal about the health benefits of functional foods but
that consumers knew very little about the risks associated with probiotics consumption.
This could be the reason for the low demand for these products. In addition, this study
emphasized the significance of consumer education about new nutritional concepts,
particularly functional foods.

Bogue, Coleman, and Sorenson (2005) led a study to investigate Irish consumers’
attitudes toward functional food as a health-enhancing food to ascertain knowledge and
awareness of nutrition benefits and how they affect food choice. The results showed that
the majority of respondents who had heard about probiotics yogurts as a functional food
were not familiar with the term “probiotics” and were not aware of their health benefits.
Consumption of healthy food was therefore positively associated with attitudes toward,
beliefs about, and knowledge of healthy foods.

The group discussion method was used to measure consumer attitudes toward the
use of probiotics (Bruhn et al., 2002). This method allows participants to express their
opinions within a structured question format. In this method, questions were used to
measure a number of things such as consumer attitude toward probiotics usage,
utilization of nutritional labels, knowledge of health claims on labels, familiarity with
probiotics strains such as Lactobacillus or Bifidobacterium, interest in possible benefits
of probiotic food products, responses to potential label statements, and reliability of
product endorsements. All participants were in agreement that labels play an important
role in the consumption of these products and that there should be more health benefits and usage information regarding quantity and frequency of consumption on these labels. The results of this research pointed to positive consumer attitudes toward using probiotics. However, some of the participants were skeptical about the health benefits associated with probiotics and indicated that an endorsement from a credible health organization would boost their confidence (Bruhn et al., 2002). In addition, the results of the study by Barrios et al. (2007) indicated that functional food products should contain labeling with more information about health benefits and ingredients.

The results of the study by McConnon et al. (2004) indicated that a great number of the public still possessed little knowledge about the science of nutrition. Functional foods were viewed differently by average consumers and nutritionists, and the difference was in perception. The important factors for consumers were health benefits and risks associated with functional food consumption. However, for nutritionists, control of and responsibility for transferring probiotics knowledge was more important. They believed that manufacturing companies should take more responsibility than the government to report any potential side effects or other important information regarding particular functional foods to consumers.

To communicate the benefits of probiotic food products, several sources were recommended to customers (Bruhn et al., 2002). These sources can be found on television or radio programs such as the news, the Discovery Channel, or talk shows. People can also obtain this information from health magazines or the internet. However, people believed that information about probiotic food products should be on labels and reviewed and approved by credible organizations such as the Food and Drug
Administration (FDA). They also indicated that the products would appear more credible if they were endorsed by a public health organization such as the National Academy of Science or American Cancer Society.

The results of the study by Armstrong et al. (2005) implied that physicians and health professionals are considered more-credible sources for obtaining and transferring information via promotional messages for health-enhancing food products. These sources were more accepted by women than men. Also, men were more interested in using government information as a source than were women. In addition, the results indicated that the media, food manufacturers, and retailers were considered less-credible sources for consumers, although they were important components for spreading information through television, store promotion, and product labeling.

The results of a study by Schultz et al. (2011) illustrated that most consumers who used probiotic supplements were influenced by the media. Additionally, individuals who did not use probiotic supplements said that they would consider using these products if they were recommended by their doctors.

The results of a study led by Carrillo, Varela, Salvador, and Fiszman (2011) showed that among Spanish participants, a low perception of functional food products’ health benefits resulted in a low frequency of consumption. Understanding factors that customers use to choose foods is significant in discovering consumer attitudes toward and interest in a healthy diet. Gathering information about the public perception of a healthy diet may allow researchers, manufacturers, and health professionals to prepare public policies or consumer education plans.
Communication to Consumers

Lähteenmäki (2004) indicated in her article that consumers should be aware of and access the health benefits of functional food products. One of the most difficult tasks is to translate the complicated scientific knowledge to a simplified language in order to make it easily understandable to the average consumer so that he or she can make educated decisions about the products. The messages related to health must be clear and separate from other messages.

Unfortunately, most scientific knowledge is based on probability, and results cannot be proven. For example, just because something is effective for most consumers does not mean that it will be effective for all. This fact must be made clear to customers. Moreover, another important factor in increasing the consumers’ confidence is to reveal the source of information provided by the manufacturer on food labels.

Gender

The behaviors of men and women toward food are drastically different. Men are less consistent than women regarding following dietary guidelines and consuming products due to health endorsements (Turrell, 1997). Although there are well-established facts on the differences in consumption of healthy foods or suggested quantities between men and women, the reasons are not exactly clear. One possible reason is that women are more knowledgeable about nutrition and food than men and are more likely to be concerned about their health and physical appearance (Turrell, 1997).

The study by Barrios et al. (2008) indicated that between young and intermediate ages of 18 to 45 there were differing opinions about functional foods among men and women participants. In the lower and intermediate groups (18–45 years), men stated that
marketing and advertising of functional foods were overwhelming, and if the men followed healthy eating habits, they should not need to consume functional foods. On the other hand, women participants were more favorable in their opinions toward the consumption of functional foods even if they indicated that they were unsure of the health benefits associated with these products. In contrast, the results of the study by Urala and Lähteenmäki (2004) implied that women were less likely to recognize functional foods as part of a healthy diet than were men and less willing to give up taste for the functional foods’ health benefits than were men.

The results of a study by Armstrong et al. (2005) indicated that when their health was at risk, women were more likely to pay a higher price for health-enhanced foods than were men. This was the same result as in the study by Teratanavat and Hooker (2006), which implied that women were more willing to purchase functional foods, organic foods, and other natural foods with higher prices.

Furthermore, the results of a study by Carrillo et al. (2011) implied that women consumed more health foods than men and held a more-positive attitude toward health foods. Moreover, a study conducted by Bogue et al. (2005) determined that women aged 35 and older were more concerned about their health and emphasized a healthy diet by following recommended dietary guidelines. Additionally, this study found that women possessed more knowledge of nutrition than did men. Generally, women tended to be more informed and knowledgeable than men about the relationship between disease and diet (Girois, Kumanyika, Morabia, & Mauger, 2000). This may stem from the fact that women were typically in charge of purchasing and preparing food for their families (Caraher, Dixon, Lang, & Carr-hill, 1998; Seechurn, Neeliah, & Neeliah, 2009). Also, the
results of another study conducted by Schultz et al. (2011) illustrated that women were more interested in using probiotic food products than were men. Men were more likely to consume functional foods if they thought that the products were needed for a specific condition. However, women were more health conscious of their diets and more likely to consume functional foods for health benefits (Niva, 2006).

**Age**

The results of the study by Armstrong et al. (2005) indicated that most consumers were not familiar with the definition of “probiotics,” and as one’s age increased, the level of one’s awareness of health-enhancing foods decreased. Moreover, the study indicated that younger participants between the ages of 16 to 24 years were more willing to purchase functional foods than were those consumers 65 years and older. In contrast, the results of a study conducted by Urala and Lähteenmäki (2004) showed that younger participants in this study held a more-negative attitude towards functional foods. It appears that younger consumers obtained fewer benefits from functional foods and were not willing to sacrifice taste for the benefit of the healthy foods. However, the results of the study by Teratanavat and Hooker (2006) indicated that younger consumers were more interested in natural foods and foods with health benefits. Moreover, they were more likely to pay more money than were older consumers, although both groups possessed the same taste preferences for health-enhancing food products.

Additionally, the results of the study conducted by Barrios et al. (2008) indicated that educated participants in the lower age brackets (18–30 and 31–45 years) were not interested in consuming functional foods. On the other hand, uneducated participants in the 31–45 age bracket and higher age bracket (46–65 years) were more likely to consume
more popular functional food products such as semi-skimmed milk, yogurts, and fermented dairy.

**Income**

Comparing higher-income individuals with lower-income individuals suggested that people with higher incomes tended to be healthier (Babones, 2010). A consumer’s choice in purchasing food depended on several factors—of which income and price of food products were the most important. Lower prices and higher incomes were the prerequisites for consumers to purchase functional foods (Seechurn et al., 2009). The results of the study conducted by Teratanavat and Hooker (2006) implied that one’s level of income influenced choice of food, and as a result, those with high incomes were more willing to pay a higher price for functional foods.

The foods people purchased and the places from which they purchased them were affected by level of income (Caraher et al., 1998). Low-income individuals were more sensitive to the price than were those with high levels of income. Normally, people with a high income enjoyed the luxury of selecting foods that were expensive and healthy, such as functional foods, for their everyday diet. However, low-income individuals purchased their food solely to satisfy their hunger and gain their basic nutrients (Caraher et al., 1998).

Normally, women, educated people, elders, and high-income individuals were more concerned about healthy eating (Niva, 2006). However, the significance of these elements was different in adopting functional foods with different health-promoting features. A study conducted by Schultz et al. (2011) showed no relationship between consumption of probiotic food products and income levels of young consumers.
Additionally, price was one of the important indicators for choosing functional foods (Seechrun et al., 2009). It appeared that consumers were willing to pay a premium price for the functional food products demonstrating a proven record for immediate effects on their health problems. This is one of the reasons why the functional food product market is limited to the people with higher incomes who can afford them (Menard, 2003). On the other hand, the development of expensive functional foods caused more socioeconomic divisions between higher-income and lower-income consumers. However, functional foods with lower prices and health benefits, known as foods with traditional health elements, can be an exception to this socioeconomic division (Niva, 2006).

The results of a study conducted by Teratanavat and Hooker (2006) indicated that people from different demographic groups responded with different reactions to functional foods, and individuals with higher incomes and higher education levels were more attracted to these products. Also, a study by Armstrong et al. (2005) showed that well-educated, young (16–34 years), and middle-aged (45–54 years) participants with high incomes could afford to pay high prices for health-enhancing food products.
CHAPTER III

METHODOLOGY

The purpose of this study was to investigate student attitudes toward and perceptions of probiotics and probiotic food products.

Procedures

The Human Subjects Committee at California State University Northridge approved the study, questionnaire, and informed consent form provided to participants involved in this study. This study used a self-report questionnaire (see Appendix) with a convenience sample of 304 students from upper- and lower-division classes in CSUN. Data were collected in November 2011. The questionnaire provided different questions to investigate student attitudes and perceptions regarding probiotics and probiotic food products. Professors of lower- or upper-division classes in Fall 2011 at CSUN were contacted by the principal investigator using e-mail or appointment to describe the purpose of the study and obtain permission for setting up dates to distribute the questionnaires in classes and collect data. After acquiring the professors’ permission and setting dates, the primary investigator went to the classes and informed participants about the purpose of the study and assured them that their participation would be voluntary and their collected data kept confidential. The principal investigator distributed the questionnaires to the participants and asked them to complete them within 15–20 minutes. Then, the data were entered into Excel and transferred into SPSS for analysis.

Sample Description

The sample population was created from two upper-division, general education classes in Family and Consumer Studies courses (FCS 340: Marriage and the Family) and
four lower-division classes: two Chicano Studies courses (CHS 100: Chicano studies), CHS 201: Chicano studies), and two Farsi courses (PERS 101: Elementary Farsi I and PERS 102: Elementary Farsi II). The sample population consisted of students aged 17–51 years old in which the mean age was 21.8 years old with the standard deviation of 3.9 years. Gender distribution of the male population was 28.3% and the female population 71.1%. The population’s ethnic background included 3.0% African American/Black, 7.6 % Asian American/Asian, 1.3% Pacific Islander/Native Hawaiian, 25.0% Caucasian/White, 41.4% Latino/Hispanic, and 9.7% other ethnicities. The population’s marital status consisted of 93.8% single, 5.6% married, and 0.3% divorced. The occupation status was as follows: 6.9% full-time students, 6.9% part-time students, 3.3% part-time workers, and 78.0% full- or part-time students who worked part-time. The population’s income distribution per month was 45.1% less than $500, 30.9% between $501-$999, 9.5% between $1000-$1499, 2.6% between $1500-$1999, 3.6% between $2000-$2499, and 4.6% more than $2500. The distribution of academic majors within the sample population was 7.6% Humanities, 24.3% Health and Human Development, 27.0% Social and Behavioral Sciences, 8.9% Art, Media, and Communication, 12.5% Science and Mathematics, 9.2% Business and Economics, 1.6% Education, 1.0% other majors, 2.6% undecided, 2.6% more than two majors. Also, the distribution for class ranks was 14.5% freshman, 11.8% sophomore, 58.6% junior, 13.8% senior, and 0.7% graduate student.

**Measurements**

The questionnaire used for this study consisted of 23 questions (see Appendix). Questions 1–3 and 7 established demographic characteristics such as age, gender,
ethnicity, and marital status. Questions 4 and 5 determined the student’s class rank and
major. Questions 6 and 8 asked the student’s income per month and employment status.
Question 9 was about the student’s current diet. Questions 10, 11, 15, and 17 were
intended to measure the student’s knowledge of probiotic food products.

The items in Question 17 specifically emphasized what participants think about
the information currently available for probiotic food products. The students were asked
whether they believed that the information currently available with probiotic food
products was sufficient, clear/simple, trustful/reliable, or contradictory/confusing.
Responses were coded as follows: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 =
agree, and 5 = strongly agree. These items were averaged to create an overall score.

Questions 12–14, 16, and 18–23 intended to reveal the college students’ attitudes
toward and perceptions of probiotic food products. This part of the questionnaire
contained a number of detailed questions that investigated factors affecting the
consumption of probiotic food products among college students as part of their daily
diets. Question 18 assessed the student’s opinion of what necessary actions should be
taken in order to improve current public knowledge about probiotic food products. This
question investigated the factors that affect public knowledge such as using less scientific
language, improving the clarity of promotional messages, devoting more time to these
products on television, improving labels, providing information to the public through
campaigns, and introducing a single brand to distinguish these products. Question 19
emphasized sources the student could select to acquire information about probiotic food
products such as consumer groups, the state, companies, physicians/specialists, and
distributors.
Question 20 contained seven detailed items regarding food choices. Students were asked to rate their agreement with the following statements: “My food choices play a key role in determining the state of my health,” “I am confused about the relationship between my diet and my health,” “When choosing foods to eat, I follow the instructions from my doctor/nutritionist,” “It is difficult to distinguish functional foods such as probiotic foods from conventional functional foods,” “When I buy foods such as probiotic food products, first I consider the price,” “It is important how the food tastes, not how it is produced,” and “I trust probiotic food labels.” Responses were coded as follows: 1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, and 5 = *strongly agree*. Responses then were averaged to create an overall score.

Question 21 consisted of five different detailed items that investigated general consumer attitudes and perceptions. Students were asked to rate their agreement with the following statements: “I am concerned about my health all of the time,” “If I heard that a new probiotic food product was available through a local store, I would be interested enough to buy it,” “I would consider buying a new probiotic food product even if I hadn’t heard of it yet,” “In general, I am the last in my circle of friends to know the names of the latest probiotic food products and trends,” and “Probiotic products are better-quality food stuffs than other food products.” Responses were coded as follows: 1 = *strongly disagree*, 2 = *disagree*, 3 = *somewhat disagree*, 4 = *neutral*, 5 = *somewhat agree*, 6 = *agree*, and 7 = *strongly agree*. Responses then were averaged to create an overall score.

Question 22 examined the student’s perceptions of and attitudes toward probiotic food products versus traditional food products by asking the student to match his points of view about probiotic food products to a number of statements: “Are less expensive/Are
more expensive,” “Are less healthy/Are healthier,” “Threaten the survival of humankind/Are essential for the survival of humankind,” “Are harmful to health/Are beneficial for health,” “Are harmful to the immune system/Are good for the immune system, “Are less nutritious/Are more nutritious,” and “Will increase the cost of public health services/Will reduce the cost of public health services.” The questions used semantic differential-type scaling that ranged from 1–10.

Finally, question 23 measured attitudes toward probiotic food products and emphasized what the student thought about these products. The questions were set up in a semantic differential format with response choices ranging from 1–7 (e.g., favorable [1] to unfavorable [7], good [1] to bad [7], and positive [1] to negative [7]).

Three different statistical analyses—Chi-square, bivariate correlation, and t-test—were conducted using the Statistical Package for the Social Science (SPSS) version 20.0 for Macintosh to analyze participants’ responses to the questionnaire. Chi-square and t-test analyses were implemented to compute the significance differences between groups. Bivariate correlations were performed to assess the strength and direction of relationship between variables. Significance was concluded at $p < .05$. 
CHAPTER IV

RESULTS

Gender Differences and Perceptions of Probiotic Food Products

Differences between men and women were assessed regarding perceptions of probiotic food products. Independent sample t-tests indicated no significant difference between men and women on (1) how often they consumed probiotic foods and (2) how much they had heard of probiotic foods (see Table 1).

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Men M</th>
<th>Women M</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you usually consume probiotic foods?</td>
<td>2.08</td>
<td>2.09</td>
<td>-.06</td>
</tr>
<tr>
<td>Have you ever heard of foods with probiotic functional foods?</td>
<td>2.55</td>
<td>2.44</td>
<td>1.11</td>
</tr>
</tbody>
</table>

* *p < .05 **p < .01

Regarding willingness to pay more for probiotic food products, the results from Table 2 indicated that only a small percentage of men and women were willing to pay more for probiotic food products, while most participants answered “don’t know.” From the participants who answered other than “don’t know,” (i.e., 31.4% men and 36.9% women), there were no significant differences between men and women (see Table 2).

Table 2

<table>
<thead>
<tr>
<th>Willing to pay more for probiotic food products?</th>
<th>%Men</th>
<th>%Women</th>
<th>ChiSquare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>13.8%</td>
<td>19.0%</td>
<td>1.35</td>
</tr>
<tr>
<td>No</td>
<td>17.6%</td>
<td>17.9%</td>
<td></td>
</tr>
<tr>
<td>Don’t Know</td>
<td>68.6%</td>
<td>63.1%</td>
<td></td>
</tr>
</tbody>
</table>

*p < .05 **p < .01
As shown in Table 3, there were no significant differences between men and women on how they defined “probiotic food products.” Almost half of men and women could not answer the question. Between 30–41% of the men and women believed that probiotic foods promoted health or reduced the risk of diseases. The results indicated that 33–40% of the men and women believed that probiotic food products enhanced the body’s biological functions (see Table 3).

Table 3  
Cross tabulations and Chi square analyses examining differences between genders on defining probiotic food products

<table>
<thead>
<tr>
<th>How would you define probiotic food products?</th>
<th>% Men</th>
<th>% Women</th>
<th>Chi Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific foods for those with health problems</td>
<td>18.1%</td>
<td>15.1%</td>
<td>.37</td>
</tr>
<tr>
<td>Foods that reduce the risk of diseases</td>
<td>29.6%</td>
<td>25.6%</td>
<td>.50</td>
</tr>
<tr>
<td>Foods that enhance the body’s biological functions</td>
<td>40.3%</td>
<td>32.6%</td>
<td>1.56</td>
</tr>
<tr>
<td>Food specifically developed to promote health or reduce the risk of disease</td>
<td>40.7%</td>
<td>30.2%</td>
<td>2.89</td>
</tr>
<tr>
<td>I could not answer</td>
<td>44.0%</td>
<td>45.3%</td>
<td>.05</td>
</tr>
</tbody>
</table>

*p < .05  **p < .01

Regarding the reasons for probiotic food consumption, only one significant difference was found. Specifically, a significantly greater percentage of women (14.0%) was more curious about probiotic food products than was men (4.6%); Chi square = 7.92, p < .01. No other significant differences between genders were found for reasons why people consume functional foods such as probiotic food products (see Table 4).
Table 4  
*Cross tabulations and Chi square analyses examining differences between genders and consumption of functional foods such as probiotic food products*

<table>
<thead>
<tr>
<th>Why do you consume functional foods such as probiotic food products?</th>
<th>Men</th>
<th>Women</th>
<th>Chi Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase my well-being</td>
<td>31.0%</td>
<td>33.7%</td>
<td>.21</td>
</tr>
<tr>
<td>Strengthen the immune system</td>
<td>31.9%</td>
<td>27.9%</td>
<td>2.91</td>
</tr>
<tr>
<td>Improve gastrointestinal function</td>
<td>25.0%</td>
<td>19.8%</td>
<td>.94</td>
</tr>
<tr>
<td>I was advised by the doctor</td>
<td>4.2%</td>
<td>8.1%</td>
<td>1.94</td>
</tr>
<tr>
<td>Out of curiosity</td>
<td>4.6%</td>
<td>14.0%</td>
<td>7.92**</td>
</tr>
<tr>
<td>I do not have a specific reason</td>
<td>21.3%</td>
<td>20.9%</td>
<td>.01</td>
</tr>
<tr>
<td>I do not consume probiotic food products</td>
<td>31.9%</td>
<td>36.5%</td>
<td>.56</td>
</tr>
</tbody>
</table>

*p < .05 **p < .01

Next, participants were asked how they obtained information about probiotic food products. The result indicated that men (25%) were significantly more likely to obtain their information for probiotic food products by reading labels more than were women (12.8%); Chi square = 5.43, *p < .05*. No other significant differences between genders were found on how they obtained information about probiotic food products (see Table 5).

Table 5  
*Cross tabulations and Chi square analyses for genders and how they obtain information about probiotic food products*

<table>
<thead>
<tr>
<th>How did you obtain information about probiotic food products?</th>
<th>Men</th>
<th>Women</th>
<th>Chi Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advertising company</td>
<td>16.1%</td>
<td>18.6%</td>
<td>.16</td>
</tr>
<tr>
<td>Trade press</td>
<td>1.9%</td>
<td>5.8%</td>
<td>3.34</td>
</tr>
<tr>
<td>Doctor/Nutritionist</td>
<td>23.6%</td>
<td>29.1%</td>
<td>.97</td>
</tr>
<tr>
<td>Friends/Relatives</td>
<td>29.6%</td>
<td>25.6%</td>
<td>.50</td>
</tr>
<tr>
<td>Specialist broadcasting TV/Radio</td>
<td>13.0%</td>
<td>12.8%</td>
<td>.00</td>
</tr>
<tr>
<td>Label products</td>
<td>25.0%</td>
<td>12.8%</td>
<td>5.43*</td>
</tr>
<tr>
<td>Public information campaigns</td>
<td>7.9%</td>
<td>14.0%</td>
<td>2.62</td>
</tr>
<tr>
<td>Internet</td>
<td>29.6%</td>
<td>39.5%</td>
<td>2.75</td>
</tr>
</tbody>
</table>

*p < .05 **p < .01
As shown in Table 6, the Chi square determined one significant difference between genders on the reasons why the participants did not consume probiotic food products. Specifically, women (15.1%) were significantly more likely than men (6.5%) to believe that they did not need probiotic food products (Chi square = 5.63, $p < .05$; see Table 6).

Table 6  
*Cross tabulations and Chi square analyses examining differences between genders and why they were not consuming probiotic food products*

<table>
<thead>
<tr>
<th>If you do not consume probiotic food products, could you tell us why?</th>
<th>Men</th>
<th>Women</th>
<th>Chi Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>I’m afraid they may have side effects</td>
<td>4.6%</td>
<td>5.8%</td>
<td>.18</td>
</tr>
<tr>
<td>Not find them in the store where I shop</td>
<td>7.4%</td>
<td>9.3%</td>
<td>.30</td>
</tr>
<tr>
<td>I do not care</td>
<td>20.8%</td>
<td>18.6%</td>
<td>.19</td>
</tr>
<tr>
<td>They are food given only for sick people</td>
<td>2.8%</td>
<td>4.7%</td>
<td>.67</td>
</tr>
<tr>
<td>I do not know their properties</td>
<td>22.7%</td>
<td>24.4%</td>
<td>.10</td>
</tr>
<tr>
<td>I do not need</td>
<td>6.5%</td>
<td>15.1%</td>
<td>5.63*</td>
</tr>
<tr>
<td>I do not think they can have an effect on my health</td>
<td>5.6%</td>
<td>3.5%</td>
<td>.56</td>
</tr>
<tr>
<td>I think they are too expensive</td>
<td>5.6%</td>
<td>7.0%</td>
<td>.22</td>
</tr>
</tbody>
</table>

*p < .05 **p < .01

As shown in Table 7, there were no significant differences between men and women on their opinions of the necessity to increase or improve the level of information currently available to the public about probiotic food products. A small percentage of women (11.6%) and men (6%) believed that there was no need to increase or improve the level of information (see Table 7).
Table 7
Cross tabulations and Chi square analyses examining differences between genders and how to increase or improve the level of information available to the public about probiotic food products

<table>
<thead>
<tr>
<th>Is it necessary to increase and/or improve the level of information currently available to the public about probiotic food products?</th>
<th>Men</th>
<th>Women</th>
<th>Chi Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>6.0%</td>
<td>11.6%</td>
<td>2.75</td>
</tr>
<tr>
<td>Using less scientific language</td>
<td>34.9%</td>
<td>34.9%</td>
<td>.00</td>
</tr>
<tr>
<td>Improve the clarity of promotional message</td>
<td>50.0%</td>
<td>38.4%</td>
<td>3.34</td>
</tr>
<tr>
<td>Devoting more space to these products on television</td>
<td>32.9%</td>
<td>30.6%</td>
<td>.15</td>
</tr>
<tr>
<td>Improving the labels</td>
<td>40.3%</td>
<td>40.7%</td>
<td>.01</td>
</tr>
<tr>
<td>Providing information to the public through campaigns</td>
<td>50.7%</td>
<td>45.3%</td>
<td>.71</td>
</tr>
<tr>
<td>By introducing single brands to distinguish these products</td>
<td>36.0%</td>
<td>36.0%</td>
<td>.00</td>
</tr>
</tbody>
</table>

*p < .05 **p < .01

There was one significant difference between men and women on their opinions of providing more information with respect to probiotic food products. Specifically, men (67.6%) were significantly more likely than women (53.5%) to believe that companies should provide accurate information on probiotic food products for the consumers; Chi square = 5.28, p < .05 (see Table 8).

Table 8
Cross tabulations and Chi square analyses examining differences between genders and opinion about the party responsible to provide more information about probiotic food

<table>
<thead>
<tr>
<th>Who, in your opinion, should provide more information with respect to probiotic food?</th>
<th>Men</th>
<th>Women</th>
<th>Chi Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>No, it is not necessary</td>
<td>5.6%</td>
<td>7.0%</td>
<td>.22</td>
</tr>
<tr>
<td>Consumer groups</td>
<td>39.8%</td>
<td>36.0%</td>
<td>.37</td>
</tr>
<tr>
<td>The state</td>
<td>31.0%</td>
<td>32.6%</td>
<td>.07</td>
</tr>
<tr>
<td>The companies that produce them</td>
<td>67.6%</td>
<td>53.5%</td>
<td>5.28*</td>
</tr>
<tr>
<td>Physicians/Specialists</td>
<td>56.9%</td>
<td>47.7%</td>
<td>2.13</td>
</tr>
<tr>
<td>The distributors (Supermarket chains/stores)</td>
<td>45.6%</td>
<td>52.3%</td>
<td>.13</td>
</tr>
</tbody>
</table>

* p < .05 ** p < .01

Independent samples t-tests found differences between men and women on perceptions about food choices, diet, and probiotic foods. Specifically, men more than
women were confused about the relationship between diet and health \((t = 1.95, p < .05)\).

Also, men were significantly more likely to trust probiotic food labels than were women \((t = -2.97, p < .01)\). In general, both men and women agreed that food choices played a key role in determining health (see Table 9).

### Table 9

*Independent samples t-tests examining differences between genders on overall attitude toward probiotic food products*

<table>
<thead>
<tr>
<th>Please rate your agreement with the following statements</th>
<th>Mean for Men</th>
<th>Mean for Women</th>
<th>(t)-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>My food choices play a key role in determining the state of my health</td>
<td>3.95</td>
<td>4.08</td>
<td>.96</td>
</tr>
<tr>
<td>I am confused about the relationship between my diet and my health</td>
<td>2.26</td>
<td>2.00</td>
<td>-1.95*</td>
</tr>
<tr>
<td>When choosing foods to eat, I follow the instructions from my doctor/nutritionist</td>
<td>2.70</td>
<td>2.71</td>
<td>.04</td>
</tr>
<tr>
<td>It is difficult to distinguish functional foods such as probiotic foods from conventional functional foods</td>
<td>3.29</td>
<td>3.25</td>
<td>-.35</td>
</tr>
<tr>
<td>When I buy foods such as probiotic food products, first I consider the price</td>
<td>3.12</td>
<td>3.26</td>
<td>.98</td>
</tr>
<tr>
<td>It is important how the food tastes, not how it is produced</td>
<td>3.09</td>
<td>2.94</td>
<td>-.98</td>
</tr>
<tr>
<td>I trust probiotic food labels</td>
<td>3.09</td>
<td>2.78</td>
<td>-2.97**</td>
</tr>
</tbody>
</table>

* \(p < .05 \) ** \(p < .01 \)

**Note:** *Strongly disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, Strongly agree = 5*

As shown in Table 10, there was a significant difference between men and women in relation to buying new probiotic food products even if they had not heard of probiotic foods \((t = -4.07; p < .01)\). Also, there was a significant difference between men and women in beliefs that probiotic food products were better-quality foods than other foods \((t = -3.03; p < .01; \text{see Table } 10)\).
Table 10
Independent samples t-tests examining differences between genders in overall attitude toward probiotic food products

<table>
<thead>
<tr>
<th></th>
<th>Mean for Men</th>
<th>Mean for Women</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am concerned about my health all of the time</td>
<td>4.78</td>
<td>4.78</td>
<td>-.02</td>
</tr>
<tr>
<td>If I heard that a new probiotic food product was available through a local store, I would be interested enough to buy it</td>
<td>4.21</td>
<td>4.02</td>
<td>-1.12</td>
</tr>
<tr>
<td>I would consider buying a new probiotic food product even if I hadn’t heard of it yet</td>
<td>3.88</td>
<td>3.17</td>
<td>-4.07**</td>
</tr>
<tr>
<td>In general, I am the last in my circle of friends to know the names of the latest probiotic food products and trends</td>
<td>3.90</td>
<td>4.08</td>
<td>.76</td>
</tr>
<tr>
<td>Probiotic products are better-quality food stuffs than other food products</td>
<td>4.28</td>
<td>3.84</td>
<td>-3.03**</td>
</tr>
</tbody>
</table>

*p < .05 **p < .01

Note: Strongly disagree = 1, Disagree = 2, Somewhat disagree = 3, Neutral = 4, Somewhat agree = 5, Agree = 6, Strongly agree = 7

Table 11 indicates no significant differences between men and women in opinions concerning probiotic foods compared with traditional foods.

Table 11
Independent samples t-tests examining differences between genders in their opinions concerning probiotic foods compared with traditional foods

<table>
<thead>
<tr>
<th>What is your opinion concerning probiotic foods compared with traditional foods</th>
<th>Mean for Men</th>
<th>Mean for Women</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less Expensive/More Expensive</td>
<td>6.36</td>
<td>6.60</td>
<td>.86</td>
</tr>
<tr>
<td>Less Healthier/More Healthier</td>
<td>6.26</td>
<td>6.42</td>
<td>.59</td>
</tr>
<tr>
<td>Threaten the survival of humankind/Essential for the survival of humankind</td>
<td>5.30</td>
<td>5.53</td>
<td>.85</td>
</tr>
<tr>
<td>Harmful to health/Beneficial for health</td>
<td>5.62</td>
<td>5.94</td>
<td>1.05</td>
</tr>
<tr>
<td>Harmful to the immune system/Good for the immune system</td>
<td>5.71</td>
<td>6.04</td>
<td>1.08</td>
</tr>
<tr>
<td>Less nutritious/More nutritious</td>
<td>5.92</td>
<td>6.04</td>
<td>.38</td>
</tr>
<tr>
<td>Will increase the cost of public health service/Decrease the cost of public health service</td>
<td>5.82</td>
<td>5.66</td>
<td>-.56</td>
</tr>
</tbody>
</table>

*p < .05 **p < .01

Note: Semantic differential-type scale ranging from 1–10
As Table 12 shows, there were no significant differences between men and women on overall attitudes toward probiotic food products.

Table 12

*Independent samples t-tests examining differences between genders in overall attitude toward probiotic food products*

<table>
<thead>
<tr>
<th>What is your overall attitude toward probiotic food products?</th>
<th>Mean for Men</th>
<th>Mean for Women</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfavorable/Favorable</td>
<td>4.61</td>
<td>4.50</td>
<td>-0.60</td>
</tr>
<tr>
<td>Bad/Good</td>
<td>4.81</td>
<td>4.63</td>
<td>-1.04</td>
</tr>
<tr>
<td>Negative/Positive</td>
<td>4.85</td>
<td>4.56</td>
<td>-1.48</td>
</tr>
</tbody>
</table>

* *p < .05 **p < .01

Note: Semantic differential-type scale ranging from 1–7

**Age, Income, and Perceptions of Probiotic Food Products**

The relationships among age, income, and perception about probiotic food products were examined using bivariate correlations. As shown in Table 13, the correlations indicated that as individuals aged, they were significantly more likely to consume probiotic food products ($r = .21, p < .01$) and have heard of probiotic food products ($r = .17, p < .01$). However, no significant correlation was found between income and consumption or hearing of probiotic foods.

Table 13

*Bivariate correlations examining relationships among age, income, and consumption and knowledge of probiotic food products*

<table>
<thead>
<tr>
<th>Do you usually consume probiotic foods?</th>
<th>Age</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you ever heard of foods with probiotic functional foods?</td>
<td>.21**</td>
<td>.03</td>
</tr>
</tbody>
</table>

* *p < .05 **p < .01

Bivariate correlations indicated that younger individuals were more likely to choose “I could not answer” when it came to defining probiotic foods ($r = -.18, p < .01$; see Table 14). Also, individuals with lower incomes were more likely to define probiotic food products as foods that reduce the risk of diseases ($r = -.11, p < .05$). No other
significant correlations were found between how people defined probiotic and (1) age and (2) income level.

Table 14

*Bivariate correlations examining relationships among age, income, and defining probiotic food products*

<table>
<thead>
<tr>
<th>How would you define probiotic food products? Please check all that apply:</th>
<th>Age</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific foods for those with health problems</td>
<td>.03</td>
<td>.08</td>
</tr>
<tr>
<td>Foods that reduce the risk of diseases</td>
<td>-.04</td>
<td>-.11*</td>
</tr>
<tr>
<td>Foods that enhance the body’s biological functions</td>
<td>.08</td>
<td>-.03</td>
</tr>
<tr>
<td>Food specifically developed to promote health or reduce the risk of disease</td>
<td>.02</td>
<td>-.07</td>
</tr>
<tr>
<td>I could not answer</td>
<td>-.18**</td>
<td>-.02</td>
</tr>
</tbody>
</table>

*p < .05 **p < .01

As shown in Table 15, younger individuals were less likely to consume probiotic food products than were older individuals (r = -.12, p < .05). Also, the results indicated that higher-income individuals were more likely to consume probiotic food products when advised by their doctors (r = .12, p < .05). No other significant correlations were found.

Table 15

*Bivariate correlations examining the relationships among age, income, and reasons for consumption of functional foods such as probiotic food products*

<table>
<thead>
<tr>
<th>Why do you consume functional foods such as probiotic food products? Please check all that apply.</th>
<th>Age</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase my well-being</td>
<td>.07</td>
<td>.06</td>
</tr>
<tr>
<td>Strengthen the immune system</td>
<td>.09</td>
<td>.01</td>
</tr>
<tr>
<td>Improve gastrointestinal function</td>
<td>.08</td>
<td>.02</td>
</tr>
<tr>
<td>I was advised by the doctor</td>
<td>.04</td>
<td>.12*</td>
</tr>
<tr>
<td>Out of curiosity</td>
<td>.07</td>
<td>.06</td>
</tr>
<tr>
<td>I do not have a specific reason</td>
<td>-.04</td>
<td>.03</td>
</tr>
<tr>
<td>I do not consume probiotic food products</td>
<td>-.12*</td>
<td>-.04</td>
</tr>
</tbody>
</table>

*p < .05 **p < .01
The correlations indicated that individuals with higher incomes were more likely to obtain their information about probiotic food products by trade press ($r = .13$, $p < .05$; see Table 16). No other significant correlations were found for age or income.

Table 16

_Bivariate correlations examining relationships among age, income, and sources of information about probiotic food products_

<table>
<thead>
<tr>
<th>How did you obtain information about probiotic food products?</th>
<th>Age</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advertising company</td>
<td>-.01</td>
<td>.04</td>
</tr>
<tr>
<td>Trade press</td>
<td>.07</td>
<td>.13*</td>
</tr>
<tr>
<td>Doctor/Nutritionist</td>
<td>.01</td>
<td>.00</td>
</tr>
<tr>
<td>Friends/Relatives</td>
<td>.06</td>
<td>.08</td>
</tr>
<tr>
<td>Specialist broadcasting TV/Radio</td>
<td>-.02</td>
<td>-.07</td>
</tr>
<tr>
<td>Label products</td>
<td>.03</td>
<td>-.01</td>
</tr>
<tr>
<td>Public information campaigns</td>
<td>-.01</td>
<td>-.01</td>
</tr>
<tr>
<td>Internet</td>
<td>-.03</td>
<td>.03</td>
</tr>
</tbody>
</table>

*p < .05 **p < .01

The bivariate correlations indicated that younger individuals were significantly less likely to care about probiotic food products as compared to older individuals ($r = -.17$, $p < .01$) and were less likely to know their properties ($r = -.12$, $p < .01$; see Table 17). No other significant correlations were found for age or income.

Table 17

_Bivariate correlations examining relationships among age, income, and reasons for not consuming probiotic food products_

<table>
<thead>
<tr>
<th>If you do not consume probiotic food products, could you tell us why? Please check all that apply.</th>
<th>Age</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>I’m afraid they may have side effects</td>
<td>-.04</td>
<td>.04</td>
</tr>
<tr>
<td>Not find them in the store where I shop</td>
<td>.02</td>
<td>.06</td>
</tr>
<tr>
<td>I do not care</td>
<td>-.17**</td>
<td>-.03</td>
</tr>
<tr>
<td>They are food given only for sick people</td>
<td>.08</td>
<td>.03</td>
</tr>
<tr>
<td>I do not know their properties</td>
<td>-.12*</td>
<td>-.02</td>
</tr>
<tr>
<td>I do not need</td>
<td>-.02</td>
<td>.04</td>
</tr>
<tr>
<td>I do not think they can have an effect on my health</td>
<td>-.06</td>
<td>-.01</td>
</tr>
<tr>
<td>I think they are too expensive</td>
<td>-.01</td>
<td>.02</td>
</tr>
</tbody>
</table>

*p < .05 **p < .01
Bivariate correlations indicated that younger individuals were significantly more likely to believe that less scientific language helped improve the level of information about probiotic foods ($r = -.13$, $p < .05$; see Table 18). The correlations also indicated that younger individuals ($r = -.13$, $p < .05$) and lower-income individuals ($r = -.15$, $p < .01$) were significantly more likely to believe that it is necessary to improve the level of information of probiotic food products by improving the clarity of promotional messages. No other significant correlations were found for age or income.

Table 18

<table>
<thead>
<tr>
<th>Is it necessary to increase and/or improve the level of information currently available to the public about probiotic food products? If yes, please check all that apply.</th>
<th>Age</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>.00</td>
<td>.07</td>
</tr>
<tr>
<td>Using less scientific language</td>
<td>-.13*</td>
<td>-.07</td>
</tr>
<tr>
<td>Improve the clarity of promotional message</td>
<td>-.13*</td>
<td>-.15**</td>
</tr>
<tr>
<td>Devoting more space to these products on television</td>
<td>.03</td>
<td>-.06</td>
</tr>
<tr>
<td>Improving the labels</td>
<td>-.01</td>
<td>-.08</td>
</tr>
<tr>
<td>Providing information to the public through campaigns</td>
<td>-.01</td>
<td>-.06</td>
</tr>
<tr>
<td>By introducing single brands to distinguish these products</td>
<td>-.06</td>
<td>-.05</td>
</tr>
</tbody>
</table>

* $p < .05$  ** $p < .01$

As Table 19 shows, younger ($r = -.10$, $p < .05$) and lower-income individuals ($r = -.17$, $p < .01$) believed that the companies that produce probiotic food products should provide more information for these products. Also, the results of this study indicated that lower-income individuals ($r = -.11$, $p < .05$) were more likely to assume that physicians and specialists were one of the most-important sources of information about probiotic food products for consumers. On the other hand, higher-income individuals ($r = .15$, $p < .01$) were less likely to believe that it is unnecessary to provide more information for probiotic food products to the public (see Table 19).
Table 19
Bivariate correlation of age, income and opinion on who should provide more information with respect to probiotic food.

<table>
<thead>
<tr>
<th>Who, in your opinion, should provide more information with respect to probiotic food? Please check all that apply.</th>
<th>Age</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>No, it is not necessary</td>
<td>-.04</td>
<td>.15**</td>
</tr>
<tr>
<td>Consumer groups</td>
<td>-.02</td>
<td>.05</td>
</tr>
<tr>
<td>The state</td>
<td>-.01</td>
<td>-.07</td>
</tr>
<tr>
<td>The companies that produce them</td>
<td>-.10*</td>
<td>-.17**</td>
</tr>
<tr>
<td>Physicians/Specialists</td>
<td>-.03</td>
<td>-.11*</td>
</tr>
<tr>
<td>The distributors (supermarket chains/stores)</td>
<td>-.04</td>
<td>-.08</td>
</tr>
</tbody>
</table>

*p < .05 **p < .01

As shown in Table 20, lower-income individuals ($r = -.19, p < .01$) and older individuals ($r = .11, p < .05$) were significantly more likely to report that their food choices played a key role in determining the state of their health. Also, lower-income individuals were more likely to follow instructions from their doctor and their nutritionist in regards to the food they consumed ($r = -.19, p < .01$).

Table 20
Bivariate correlations examining relationships among age, income, and overall attitudes toward and perceptions of probiotic food products

<table>
<thead>
<tr>
<th>Please rate your agreement with the following statements</th>
<th>Age</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>My food choices play a key role in determining the state of my health</td>
<td>.11*</td>
<td>-.19**</td>
</tr>
<tr>
<td>I am confused about the relationship between my diet and my health</td>
<td>-.10*</td>
<td>-.04</td>
</tr>
<tr>
<td>When choosing foods to eat, I follow the instructions from my doctor/nutritionist</td>
<td>.07</td>
<td>-.19**</td>
</tr>
<tr>
<td>It is difficult to distinguish functional foods such as probiotic foods from conventional functional foods</td>
<td>-.04</td>
<td>-.07</td>
</tr>
<tr>
<td>When I buy foods such as probiotic food products, first I consider the price</td>
<td>-.01</td>
<td>-.09</td>
</tr>
<tr>
<td>It is important how the food tastes, not how it is produced</td>
<td>-.05</td>
<td>-.06</td>
</tr>
<tr>
<td>I trust probiotic food labels</td>
<td>.08</td>
<td>-.09</td>
</tr>
</tbody>
</table>

*p < .05 **p < .01
Note: Strongly disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, Strongly agree = 5
As shown in Table 21, older \((r = .11, p < .05)\) and lower-income individuals \((r = -.26, p < .01)\) were significantly more concerned about their health all of the time. Also, older individuals believed that probiotic food products contain better-quality food stuff than do other food products in the market. On the other hand, lower-income individuals determined that if they hear that a new probiotic food product is available through a local store, they would be more interested in buying it \((r = -.11, p < .05)\). In general, both genders with different incomes were slightly positive regarding the consumption of probiotic food products.

### Table 21

*Bivariate correlations examining relationships among age, income, and overall attitude and perception toward probiotic food products*

<table>
<thead>
<tr>
<th>Please rate your agreement with the following statements</th>
<th>Age</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am concerned about my health all of the time</td>
<td>.11*</td>
<td>-.26**</td>
</tr>
<tr>
<td>If I heard that a new probiotic food product was available through a local store, I would be interested enough to buy it</td>
<td>.04</td>
<td>-.11*</td>
</tr>
<tr>
<td>I would consider buying a new probiotic food product even if I hadn’t heard of it yet</td>
<td>.04</td>
<td>-.05</td>
</tr>
<tr>
<td>In general, I am the last in my circle of friends to know the names of the latest probiotic food products and trends</td>
<td>.04</td>
<td>.01</td>
</tr>
<tr>
<td>Probiotic products are better-quality food stuffs than other food products</td>
<td>.11*</td>
<td>.03</td>
</tr>
</tbody>
</table>

\*\(p < .05\) **\(p < .01\)

Note: Strongly disagree = 1, Disagree = 2, Somewhat disagree = 3, Neutral = 4, Somewhat agree = 5, Agree = 6, Strongly agree = 7

As shown in Table 22, older individuals believed that probiotic food products are more expensive compared to traditional food products \((r = .14, p < .05)\). Also, the results of the study indicate no significant differences between age and income on other opinions concerning probiotic food products compared with traditional foods.
Table 22
*Bivariate correlations examining relationships among age, income, and attitudes toward probiotic food products compared to traditional foods*

<table>
<thead>
<tr>
<th>What is your opinion concerning probiotic foods compared with traditional foods</th>
<th>Age</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are less expensive/Are more expensive</td>
<td>.14*</td>
<td>-.09</td>
</tr>
<tr>
<td>Are less healthy/Are more healthy</td>
<td>.03</td>
<td>-.03</td>
</tr>
<tr>
<td>Threaten the survival of humankind/Are essential for the survival of humankind</td>
<td>-.06</td>
<td>-.02</td>
</tr>
<tr>
<td>Are harmful to health/Are beneficial for health</td>
<td>-.02</td>
<td>.01</td>
</tr>
<tr>
<td>Are harmful to the immune system/Are good for the immune system</td>
<td>-.02</td>
<td>.01</td>
</tr>
<tr>
<td>Are less nutritious/Are more nutritious</td>
<td>-.09</td>
<td>-.01</td>
</tr>
<tr>
<td>Will increase the cost of public health service/Will reduce or decrease the cost of public health service</td>
<td>-.01</td>
<td>.03</td>
</tr>
</tbody>
</table>

*p < .05 **p < .01
Note: Semantic differential-type scale ranging from 1–10

As shown in Table 23, older individuals held more overall positive attitudes toward probiotic food products (*r* = .25, *p* < .01; see Table 23).

Table 23
*Bivariate correlations examining relationships among age, income, and overall attitude toward probiotic food products*

<table>
<thead>
<tr>
<th>What is your overall attitude toward probiotic food products?</th>
<th>Age</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfavorable/Favorable</td>
<td>.25**</td>
<td>.05</td>
</tr>
<tr>
<td>Bad/Good</td>
<td>.04</td>
<td>-.02</td>
</tr>
<tr>
<td>Negative/Positive</td>
<td>-.09</td>
<td>.07</td>
</tr>
</tbody>
</table>

*p < .05 **p < .01
Note: Semantic differential-type scale ranging from 1–7
CHAPTER V
DISCUSSION

The rise in health care expenditures along with the rise in chronic diseases led consumers and manufacturers to start looking at food that not only satisfied hunger but also provided a way to live a healthier and longer life. As a result, in the last two decades, an enormous market was created by food manufacturers to fill this niche (Niva & Mäkelä, 2007). One of the most important functional food types is probiotics. Many studies were conducted regarding the benefits of probiotic food products and their positive effects on a variety of diseases; however, there are few studies that focus on the consumers’ perceptions of and knowledge about probiotic food products. Therefore, there is a need for a study to better understand the consumers’ opinions of this kind of health food and the factors that would affect decisions to use them. The present study addresses this need and evaluates CSUN students’ perceptions of probiotic food products based on gender, income, and age.

The present study’s results helped measure the consumers’ perceptions of probiotic food products, the level of public knowledge about probiotics, and how we can improve both. In addition, the results of this study can be used by probiotic food manufacturers to target consumers in an effective way.

The sample population for the present study was limited to a specific segment of the general public, CSUN students. However, this group is considered a valid representation of the general public to evaluate perceptions of probiotic food products because this sample population represents future consumers as they begin to enter the job
market and create the new families. Moreover, the sample size was very large in this study (N = 304).

**Perception & Attitude**

The present study was based on studies conducted in recent years. The behaviors of men and women toward food, especially health-enhancing foods, are significantly different. Men are less consistent than women in following dietary guidelines and consuming certain products based on health endorsements. Although there are well-established facts that suggest a difference between men and women and their likelihood to consume healthy foods and/or suggested quantities, often the reasons for differences are not clear. One possibility for this might be that women were regarded as more knowledgeable about nutrition and food than men, and they were more likely to be concerned about their health and physical appearance (Turrel, 1997). This was in agreement with the present study, which also indicated differences between men and women in their perceptions about their health, food choices, diet, and probiotic functional foods. Particularly, men seemed significantly less knowledgeable about the relationship between diet and health than were women (see Table 9).

The results of the study by Carrillo et al. (2011) showed that a low perception of functional foods results in less probiotics consumption, and the study conducted by Barrios et al. (2008) indicated that women possessed a more positive attitude toward probiotics than men. This was not in agreement with the results of the present study, which indicated no significant difference between men and women in their perceptions and attitudes toward probiotic functional food products (see Table 12).
Additionally, the results of a study conducted by Bogue et al. (2005) indicated that the majority of respondents who had heard about probiotics yogurts were not aware of their benefits. Also, the results of another study conducted by Viana et al. (2008) illustrated a lack of public knowledge about the definition of probiotic food products. This was in agreement with the results of the present study, which indicated that regardless of gender, people could not define “probiotic functional food products” and were unaware of their health benefits. In fact, only a small percentage of men and women could define these products (see Table 3).

Furthermore, women tended to be more aware of and knowledgeable about the relationship between diseases and diet than were men (Girois et al., 2009) because women are more likely to be in charge of the purchasing and the preparation of food in most families. (Carafer et al. 1998; Seechurn et al., 2009).

This contrasted against the results of the present study, which found that according to the participants’ responses, there were no significant differences between men and women in knowledge about probiotic functional foods (see Table 1).

As shown in Table 10, there was a significant difference between men and women when considering purchasing new probiotic food products, especially if they had not heard of the products before. In addition, there was a significant difference in opinion between men and women when asked whether they believed that probiotic food products are better in quality than other foods. This suggests that improving the public’s knowledge about probiotic functional foods through a variety of campaigns will improve the public’s perception of these kinds of foods. Moreover, as a result, this has the
potential to increase consumer confidence in purchasing probiotic functional foods, cause
an increase in public health, and decrease the cost of health care.

Furthermore, the present study’s results illustrated that there were no differences
between how often men and women consume probiotic functional food (see Table 1). Also, there were no significant differences between men and women who did not have a specific reason to consume probiotic functional foods (see Table 4). This contrasted against the study conducted by Urala and Lähteenmäki (2004), which implied that women were not willing to consume functional foods as part of a healthy diet; moreover, they were less likely to give up taste for the health benefits of the functional foods than were men. However, the study conducted by Bogue et al. (2005) determined that women aged 35 and older were more interested in their health, more knowledgeable about nutrition, and more concerned about following dietary guidelines. The study also concluded that women possessed more nutritional knowledge than did men.

In addition, when students were asked why they consumed functional foods such as probiotic food products, a greater percentage of women indicated that they were curious. There were no other significant differences found for the consumption of functional foods such as probiotic functional foods (see Table 4). Similarly, a study conducted by Schultz et al. (2011) implied that women were more interested in consuming probiotic food products than were men. Moreover, women consumed functional foods for their health benefits, while men consumed them for specific health conditions (Niva, 2006).
Age

Regardless of age and income, women maintained a more-positive attitude toward health food (Carrillo et al., 2011). However, this study conflicted with the results of the present study, which indicated that regardless of income, age was a factor, and older individuals held more positive attitudes toward probiotic food products, although they believed that probiotic functional foods were more expensive in comparison to traditional food products (see Tables 22 and 23).

The results of the study by Jezewska-Zychowicz (2009) indicated that young consumers were more willing to purchase functional foods, and elements such as need, positive attitude towards a healthy life, and safety considerably influenced their decisions to use functional foods. This was not in agreement with the results of the present study. The present study indicated that younger individuals were less willing to purchase and consume probiotic functional foods (see Table 15); furthermore, they did not offer specific reasons for consuming functional probiotic foods and were less likely to know their properties (see Table 17). The lack of reasoning for purchasing probiotic functional food products may be due to a lack of knowledge about these kinds of foods. In addition, purchasing traditional foods is much easier and less time consuming than purchasing functional foods such as probiotic food products. These kinds of health-enhancing foods must be purchased from specific health stores and markets, which are not as easily accessible as regular grocery stores.

Additionally, the present study’s results showed that younger individuals were not willing to purchase probiotic food products because they were not aware of their benefits and properties. Moreover, it was indicated that they did not actually care about probiotic
food products (see Table 17). This was in agreement with the findings of the study by Urala and Lähteenmäki (2004), which indicated that younger participants were not willing to purchase functional food products because they did not want to sacrifice taste for the benefits of a healthy food. However, the present study’s results contrasted against the results of the study by Armstrong et al. (2005), which concluded that younger people were more willing to purchase the functional foods than were older consumers, specifically those aged 65 and older.

Moreover, the results of the study conducted by Teratanavat and Hooker (2006) implied that even within groups of older and younger consumers with the same taste preferences, younger consumers were more willing to consume and pay more for foods with health benefits. However, this was in contrast with the present study; regardless of gender, older participants demonstrated that they were considerably more likely to consume probiotic functional foods (see Table 15). This contrast may be caused by our sample population of CSUN students, within which the age differences were not as broad as in the general population.

The results of the present study suggested that, regardless of income, the older participants were more knowledgeable about probiotic functional foods than were younger participants. Also, there were significant differences between ages among students who could and could not define “probiotic functional foods.” The present study revealed that older individuals were more aware of probiotic functional foods and were more likely to be able to define them (see Tables 13 and 14). These results contrasted against results of the study conducted by Armstrong et al. (2005), which indicated that as people aged, the level of their awareness of functional food decreased.
Also, regardless of gender or age, individuals with higher incomes tended to be healthier than individuals with lower incomes (Babones, 2010). In general, high-income, educated, female, and elderly individuals were more involved in healthy eating. However, there were differences in consuming functional foods and other health-promoting food functions (Niva, 2006). This was in disagreement with the results of the present study, which indicated that low-income individuals believed that their choices played a key role in determining the state of their health and instructions from their doctors or nutritionists also played an important role in the selection of foods that they consume (see Table 20). The results from the present study may come from the fact that our population samples were students and they were likely not to have steady incomes.

The results of a study conducted by Teratanavat and Hooker (2006) indicated that higher income individuals are more likely to purchase probiotic food products because they are more expensive than traditional foods. On the other hand, according to Armstrong et al. (2005) and Urala and Lähteenmäki (2004) women were more willing to purchase probiotic food products, when they feel their health was at risk. In general, higher incomes and lower prices were major factors for consumers when purchasing functional foods (Menard, 2003; Seechurn et al., 2009). This supported the results of the present study, which illustrated that income affected consumption of probiotic food products. Moreover, people with higher incomes who were advised by their doctors were more interested in probiotic food products than were lower-income individuals (see Table 15). On the other hand, the results of the study conducted by Schultz et al. (2011) were in
contrast with the present study, indicating that there was no relationship between the consumption of probiotic food products and the incomes of young consumers.

One’s level of income influences choices for food, and as a result, those with higher incomes were more willing to pay the higher price for functional foods (Caraher et al., 1998). This was in disagreement with the present study’s results, which showed that lower-income individuals were not influenced by their economic status in selecting healthier foods. They believed that their choices in food played a key role in determining the state of their health (see Table 20). On the other hand, high-income individuals possessed the luxury of selecting foods that were expensive and healthy like functional foods; however, low-income individuals purchased their foods solely to satisfy their hungers and gain basic nutrition (Caraher et al., 1998). In contrast, the present study’s results indicated no significant relationship between differences in income and the cost of probiotic functional foods (see Table 20).

**Sources of Information**

The results of the study by McConnon et al. (2004) indicated that scientists know a great deal about the health benefits of probiotics; however, consumers still know very little about them and the risks associated with probiotic functional food product consumption. This could be the reason for the low demand for these products. This study also emphasized the significance of the consumers’ education about new nutritional concepts, particularly probiotic functional foods. This is in agreement with the present study, which showed that when they were asked whether they had ever heard of probiotic functional foods, almost half of the participants could not answer the question (see Table 3).
There are several sources by which to obtain information about the benefits of probiotic functional food products (television, radio, and newspaper). The results of the study by Barrios et al. (2007) implied that labels for functional foods should offer more information about health benefits and ingredients. However, many people believed that information should be on the labels and reviewed and approved by a credible organization such as the FDA (Bruhn et al., 2002). On the other hand, the results of a study by McConnon et al. (2004) indicated a lack of consumer trust regarding the control of label information by manufacturers and the government. In the present study, the results indicated that individuals with higher incomes obtained their probiotic food product information from trade press (see Table 16). The results of the present study illustrated that low-income individuals believed that it is necessary to improve the level of circulating information about probiotic functional food products by improving the clarity of promotional messages. In addition, younger participants indicated that less scientific language will help improve the level of understanding among the public (see Table 18). Furthermore, the results of the present study pointed to the fact that younger, low-income individuals believed that the companies that produce probiotic food products should provide more information about their products. On the other hand, high-income individuals believed that it was not necessary to provide more information for probiotic food products to the public. Also, the results of this study indicated that low-income individuals assumed that physicians and specialists were one of the most important sources from which they could obtain more information about probiotic functional food products (see Table 19). This was in agreement with the results of the study conducted by Armstrong et al. (2005), which determined that participants preferred using
doctors/health care professionals as credible sources for acquiring information regarding health-enhancing products.

These sources were generally more favored among women than men. The results of a study by Schultz et al. (2011) indicated that media, manufacturers, and retailers play a key role in spreading information about the benefits of probiotic food products. Additionally, according to the study by Urala and Lähteenmäki (2004) this information should be more accessible and easily understandable to the average consumers.

**Implication**

The results of the present study implied that there is a lack of knowledge about functional foods, especially probiotic functional foods. This suggested that college students as consumers need to be aware of and educated about new health-enhanced foods. In order to achieve this goal, there should be a collective effort by scientists, nutritionists/physicians, manufacturers, the government, and consumers. One way to address this problem is to convey information to the consumer in a simple and convincing way.

In this study, it was revealed that the majority of the students were not motivated to learn more about these products. First, students must be motivated to introduce probiotic functional foods into their diets. Companies must send a clear message that will encourage them to educate themselves on probiotic functional food health benefits. This can be done using campus broadcasting, a health fair with free educational classes and samples, and television and internet advertising. Advertisements should be made very truthfully and carefully so that they do not mislead the public in any way.
In general, this study determined that there are different opinions regarding how information about probiotic food properties should be spread to students. These results can be used by probiotic functional food manufacturers to introduce their products to the general public, especially to young consumers such as college students. Moreover, the results of this study indicated that manufacturers, nutritionists, and physicians should be more proactive in translating difficult scientific terminologies into something the general public can understand. These terminologies are usually used on the labels and during nutritional or physician sessions. Moreover, these health specialists and health product manufacturers should take more care and effort to inform the public of new scientific findings and general information by being more involved in the labeling of these products and the promotional messages/information circulated.

Finally, more studies should be conducted about the probiotic health benefits and how to inform the consumers about these benefits.

**Limitations & Conclusions**

To accurately conclude the results, we must address the limitations of this study. The sample population was limited to students at California State University Northridge, which limits the ability to generalize the results. Also, the data were obtained by a cross-sectional study design through self-report surveys about college students’ perceptions of probiotics and probiotic food products. While the present study’s population sample of CSUN students is considered only a part of the general population, it still provides valuable understanding of and insight into a new generation of consumers’ perception toward probiotic functional food products. In addition, data were collected by using a cross-sectional study design through a self-report questionnaire, which may affect results
of this study. Future studies should examine actual purchasing and consumption of
probiotic foods through analyzing grocery and meal receipts and diet diaries.

The results of this study will provide additional information for consumers to
choose foods that will provide them with a better and healthier life. Moreover, this study
can help food manufacturers market their products in more effective and profitable ways.
The most important point that this study demonstrated is that there is a lack of knowledge
about probiotic functional food products among the general public, even among educated
consumers such as CSUN students.

Finally, it is necessary to make more of an effort to educate the public about
probiotic functional food products; moreover, there should be more efforts to educate the
public and also to further investigate the benefits of these products.
REFERENCES


APPENDIX

Questionnaire on Probiotic Perception and Attitude


2. Ethnicity?
   1. African American/Black 2. Asian American/Asian
   3. Native American 4. Pacific Islander/Native Hawaiian
   7. Others _____________________________

3. Marital status?

4. Class rank?

5. Major? _____________________________

6. Income per month?

7. Age? ________________

8. Work status?
   1. Full-time student 2. Part-time student 3. Part-time worker

9. How would you describe your current diet?
   1. Not at all healthy 2. Little healthy 3. On average healthy
   4. Enough Healthy 5. Very healthy

10. Have you ever heard of foods with probiotic functional properties?
    1. Do not know them at all 2. I know vaguely 3. I know enough 4. I know
    5. I know them very well

11. How would you define probiotic foods? Please check all that apply.
    □ Specific foods for those with health problems
    □ Foods that reduce the risk of diseases
    □ Foods that enhance the body's biological functions
    □ Food specifically developed to promote health or reduce the risk of diseases
    □ I could not answer
    □ Other (specify) ________________________________

12. Do you usually consume probiotic foods?
    1. No, never 2. I’ve held one 3. At times 4. Often 5. Always

13. Are you willing to pay more for probiotic food products?
    1. Yes 2. No 3. I don’t know
14. Why do you consume functional foods such as probiotic food products? Please check all that apply.
- □ Increase my well-being
- □ Strengthen the immune system
- □ Improve gastrointestinal function
- □ I was advised by the doctor
- □ Out of curiosity
- □ I do not have a specific reason
- □ I do not consume probiotic food products

15. How did you obtained information about probiotic food products? Please check all that apply.
- □ Advertising company
- □ Trade press
- □ Doctor / Nutritionist
- □ Friends / Relatives
- □ Specialist broadcasting TV / Radio
- □ Labels products
- □ Public information campaigns
- □ Internet

16. If you do not consume probiotic foods, could you tell us why? Please check all that apply.
- □ I'm afraid they may have side effects
- □ Not find them in the store where I shop
- □ I do not care
- □ They are given food only for sick people
- □ I do not know their properties
- □ I do not need
- □ I do not think they can have an effect on my health
- □ I think they are too expensive
- □ Other (specify)_____________________________________

17. Do you believe that the information currently available to you comes with probiotic food products are:

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Slightly agree</th>
<th>Mildly agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sufficient</td>
<td>1</td>
<td>2</td>
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<tr>
<td>Clear and simple</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>5</td>
</tr>
<tr>
<td>Truthful and reliable</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>5</td>
</tr>
<tr>
<td>Contradictory and confusing</td>
<td>1</td>
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</table>

18. Is it necessary to increase and/or improve the level of information currently available to the public about probiotic food products? If yes, please check all that apply.
- □ No
- □ Using a less scientific language
- □ Improve the clarity of promotional message
- □ Devoting more space to these products on television
- □ Improving the labels
- □ Providing information to the public through campaigns
- □ By introducing single brands to distinguish these products
19. Who, in your opinion, should provide more information with respect to probiotic food? Please check all that apply.
- No, it is not necessary
- Consumer groups
- The state
- The companies that produce them
- Physicians/ Specialists
- The distributors (Supermarket chains/ stores)
- Others (Specify) ____________________________________________________________________________

20. Please rate your agreement with the following statements

<table>
<thead>
<tr>
<th>My food choices play a key role in determining the state of my health</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
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<table>
<thead>
<tr>
<th>I am confused about the relationship between my diet and my health</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
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</table>

<table>
<thead>
<tr>
<th>When choosing foods to eat, I follow the instructions from my doctor / nutritionist</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
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</table>

<table>
<thead>
<tr>
<th>It is difficult to distinguish functional foods such as probiotic foods from conventional functional foods.</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
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<table>
<thead>
<tr>
<th>When I buy foods such as probiotic food products, first I consider the price.</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
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<tr>
<th>It is important how the food tastes, not how it is produced.</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
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<table>
<thead>
<tr>
<th>I trust probiotic food labels.</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
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21. Please rate your agreement with the following statements

<table>
<thead>
<tr>
<th>I am concerned about my health all the time.</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Some what disagree</th>
<th>Neutral</th>
<th>Some what agree</th>
<th>Agree</th>
<th>Strongly agree</th>
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<td>6</td>
<td>7</td>
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<table>
<thead>
<tr>
<th>If I heard that a new probiotic food product was available through a local store, I would be interested enough to buy it</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Some what disagree</th>
<th>Neutral</th>
<th>Some what agree</th>
<th>Agree</th>
<th>Strongly agree</th>
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<table>
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<tr>
<th>I would consider buying a new probiotic food product, even if I hadn’t heard of it yet</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Some what disagree</th>
<th>Neutral</th>
<th>Some what agree</th>
<th>Agree</th>
<th>Strongly agree</th>
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<table>
<thead>
<tr>
<th>In general, I am the last in my circle of friends to know the names of the latest probiotic food products and trends.</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Some what disagree</th>
<th>Neutral</th>
<th>Some what agree</th>
<th>Agree</th>
<th>Strongly agree</th>
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<table>
<thead>
<tr>
<th>Probiotic products are better quality food stuffs than other food products.</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Some what disagree</th>
<th>Neutral</th>
<th>Some what agree</th>
<th>Agree</th>
<th>Strongly agree</th>
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</table>
22. We want to know your opinions concerning probiotic foods, compared with traditional foods. For each pair of statements, please indicate on a scale of 1 to 10, how close each statement matches your point of view. Would you say that functional foods such as probiotic foods:

<table>
<thead>
<tr>
<th>Statement</th>
<th>Scale 1</th>
<th>Scale 2</th>
<th>Scale 3</th>
<th>Scale 4</th>
<th>Scale 5</th>
<th>Scale 6</th>
<th>Scale 7</th>
<th>Scale 8</th>
<th>Scale 9</th>
<th>Scale 10</th>
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<tbody>
<tr>
<td>Are less expensive</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
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<tr>
<td>Are less healthy</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
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<tr>
<td>Threaten the survival of humankind</td>
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<td>6</td>
<td>7</td>
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<td>9</td>
<td>10</td>
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<tr>
<td>Are harmful to health</td>
<td>1</td>
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<td>6</td>
<td>7</td>
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<td>Are harmful to the immune system</td>
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<td>10</td>
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<tr>
<td>Are less nutritious</td>
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<td>Will increase the cost of public health services</td>
<td>1</td>
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23. What is your overall attitude toward probiotic food products?

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<tr>
<th>Attitude</th>
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<th>Scale 2</th>
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<td>Unfavorable</td>
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<tr>
<td>Bad</td>
<td>1</td>
<td>2</td>
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<td>Negative</td>
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<tr>
<td>Favorable</td>
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<td>Good</td>
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Thank You