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Honors Thesis

# Food Safety Attitudes in College Students

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**Abstract**

College students are one of the most at-risk population groups for food poisoning, due to risky food safety behaviors. Using the Likert Scale, undergraduate students were asked to participate in a Food Safety Survey which was completed by 499 students ages 18-25. Data was analyzed using SPSS and AMOS statistical software. Four conceptual definitions regarding food safety were defined as: general food safety, bacterial food safety, produce food safety, and politics associated with food safety. Knowledge seems to be an important factor in shaping student's attitudes regarding general and bacterial safety. Ethnicity plays a role in how people view the politics of food safety, and perception of the safety of organic food.

## Introduction

It is estimated that foodborne diseases cause approximately 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths annually in the United States [1]. College students are one of the most at-risk population groups due to risky food safety behaviors. Food safety is of particular concern in university settings because many college students are preparing meals for themselves and others for the first time in life [2]. Diarrhea is a major symptom of foodborne illness; however, diarrhea in college students may also be attributed to other things such as excessive alcohol consumption, stress, anxiety, antibiotic use, and use of food additives [3-4].

A study conducted at Ohio State University concluded that undergraduate students do engage in behaviors that place them at risk, including risky food handling and food consumption. College students are at a higher risk for foodborne illness than the general population [2]. A cross-sectional online food safety survey found that young adults engage in risky eating behaviors like eating raw/undercooked foods of animal origin and other less than optimal safe food handling practices. Due to the challenges of obtaining a college education, many students eat whatever is convenient. Male respondents and whites consumed more risky foods compared with female respondents and nonwhites. Authors concluded that food safety educational efforts should focus on increasing knowledge, particularly in males [5-6]. A study conducted at Kansas State University examined the effect of educational intervention in food safety on college students. Findings indicated that interactive food safety education intervention resulted in improved food safety knowledge and beliefs. The strongest effects were seen in students who described that food safety principles were important to their future professions, e.g. health majors [7]. Students in health related majors had higher food safety knowledge scores than students in other disciplines, yet even they scored on average only 74% on a food safety knowledge test [4]. Dietetics and hospitality students seem to do better because their programs provide more hours of food safety education,

and some require or offer also food safety certifications [8-9]. A study conducted on four Japanese universities concluded that students who had more knowledge of food safety implemented more risk-reduction behaviors, as well as students who completed a basic food class or were working toward a degree in food or nutrition [10].

In developed societies food safety encompasses much more than just handling, preparation, and storage of food in ways that prevent foodborne illness. It also embraces concepts like attitudes toward environment (organic farming, vegetarian or vegan lifestyle), politics (regulation or deregulation of governmental food safety institutions), race, gender and other determinants. Although there have been several studies published on the many aspects of food safety among college students it is not clear what are the underlying factors associated with attitudes and beliefs toward food safety. The goal of this report was to (i) test general nutritional knowledge among college students, (ii) examine beliefs and attitudes toward food safety and (iii) report a theoretical model of the relationships between General Food Safety, Bacterial Food Safety, Produce Safety, and the Politics of Food Safety.

## **Experimental Section**

### *2.1. Recruitment of Subjects*

This cross-sectional observational study was done at Andrews University, which is a Seventh-day Adventist (SDA) institution of higher learning. SDAs represent a unique population to study due to their wide range of dietary habits. This religious group endorses healthy lifestyle and recommends that members adhere to lacto-ovo-vegetarian diet. The study was approved by the University's Institutional Review Board (IRB protocol # 11-143). Students from various undergraduate courses were asked to participate in the study. Participation in the study was voluntary. Data was collected in November of 2011.

## 2.2. Assessment of Food Intake, Attitudes toward Food Safety, and Nutrition Knowledge

Each participant was asked to complete a four-page *Lifestyle Practices Survey*, which was comprised of four parts: the first part had 15 basic census questions (gender, age, ethnicity, marital status, class standing, questions regarding exercise habits, height, weight, vegetarian status). In the second section, a 31-item Food Frequency Questionnaire (FFQ) was used to accurately ascertain the vegetarian status and nutrition habits of the participants. In the third section, participants were asked to react to a series of 20 statements about food safety using the Likert Scale ranging from 1 (strongly disagree) to 7 (strongly agree). The questions were divided into four categories: general food safety, bacterial food safety, produce food safety, and politics of food safety (Table 1). This section of the survey was adapted from a survey used by a doctoral student at Kansas State University [11]. In the fourth section, students were given eighteen true or false questions to test their knowledge in general nutrition (Table 2).

**Table 1.** Selected questions used to assess attitudes towards food safety

<b>General Food Safety</b>
Leaving leftovers out after a meal is safe, as long as the food is reheated before eating again.
Buying dented cans is safe.
Drinking unpasteurized milk is safe.
<b>Bacterial Food Safety</b>
It is important to wash hands with hot water and soap before eating or working with food.
Any food can be a vehicle for foodborne illness
Meat is more susceptible to food toxins than fruits and vegetables.
<b>Produce Food Safety</b>
Eating produce treated with pesticides makes food dangerous to health.
Organic food is healthier because it is higher in minerals and vitamins.
Organically farmed food is always a healthier choice than food from traditional farming practices.
<b>Politics</b>
Republicans try to suppress food safety regulations.
Democrats tend to pass more legislation regarding the food industry than Republicans.
Foodborne illnesses are increasing due to USDA deregulation.

**Table 2.** Selected questions used to assess nutritional knowledge**Nutritional Knowledge**

Oranges and lemons are a good source of vitamin C.  
 Meat should be heated to at least 160 degrees to kill foodborne pathogens.  
 Vitamin E is called the sunshine vitamin.

**Results***3.1. Sample Size and Characteristics*

Overall, there were 550 participants who completed the survey; 51 subjects were disqualified because they were not between the ages 18 to 25, leaving a study population of 499 (42% males and 58% females). The mean age was 20.0 years for males, and 19.8 years for females. The mean BMI was 24.3 for males and 23.5 for females. The majority of males and females were SDAs, Caucasian, omnivore and would be considered knowledgeable about nutrition (Table 3).

**Table 3.** Selected Characteristics of Participants

	Males	Females
Gender (% <i>, n</i> )	42 (209)	58 (290)
Age (years; mean, SD)	20 ( $\pm$ 1.7)	19.8 ( $\pm$ 2.1)
BMI (kg/m <sup>2</sup> ; mean, SD)	24.3 ( $\pm$ 4.9)	23.5 ( $\pm$ 5.2)
Seventh-day Adventist (% <i>, n</i> )	94 (197)	93 (269)
Ethnicity (% <i>, n</i> )		
Caucasian	38 (72)	30 (79)
African American	27 (50)	28 (19)
Hispanic	16 (31)	23 (74)
Asian	15 (29)	7 (59)
Other	15 (7)	12 (32)
Knowledge (% <i>, n</i> )		
A (90-100%)	4 (8)	7 (21)
B (80-89%)	31 (64)	27 (78)
C (70-79%)	35 (74)	38 (110)
D (60-69%)	29 (61)	26 (74)
F (0 – 59%)	1 (2)	2 (7)
Vegetarian Status (% <i>, n</i> )		
Vegetarian	31 (65)	37 (107)
Omnivore	69 (144)	63 (183)

SD stands for standard deviation; BMI stands for Body Mass Index



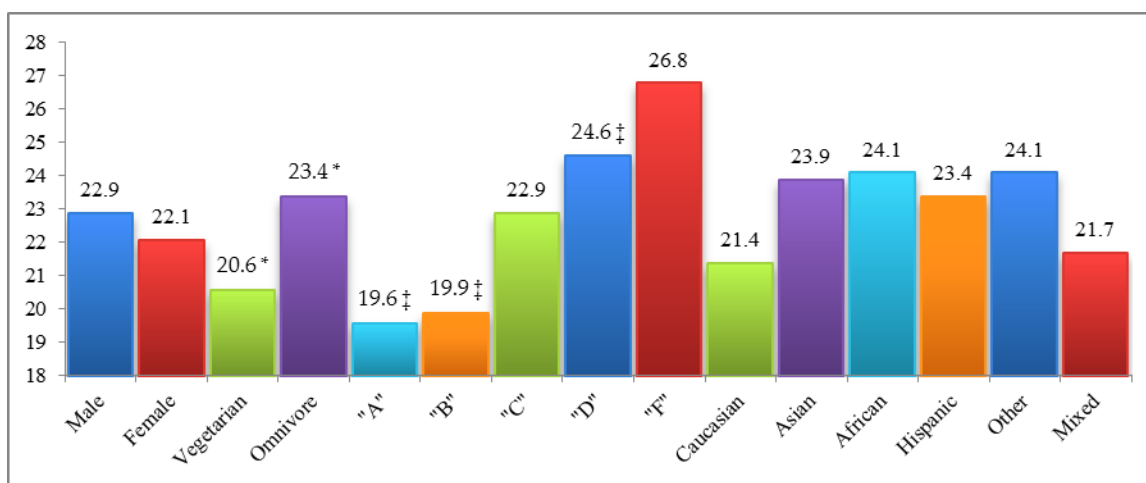
### 3.2. Food Safety Attitudes

Food safety was divided into four underlying constructs: *General Food Safety*, *Bacterial Food Safety*, *Produce Safety*, and *the Politics of Food Safety*. Ethnicity, vegetarian status, knowledge, and gender were tested for significant differences in attitudes toward these four constructs.

#### 3.2.1. General Food Safety

There were nine questions assessing this section, which was measured on an inverse scale, meaning a positive score indicated a negative attitude towards general food safety. There were significant differences regarding general food safety between vegetarians and omnivores, with vegetarians having a more positive view towards general food safety. There were also significant differences between people who scored an “A” or “B” on the nutrition quiz, and those who received a lower score. The people who scored well tended to have a more positive attitude towards general food safety.

**Figure 1.** Attitudes toward general food safety for selected groups

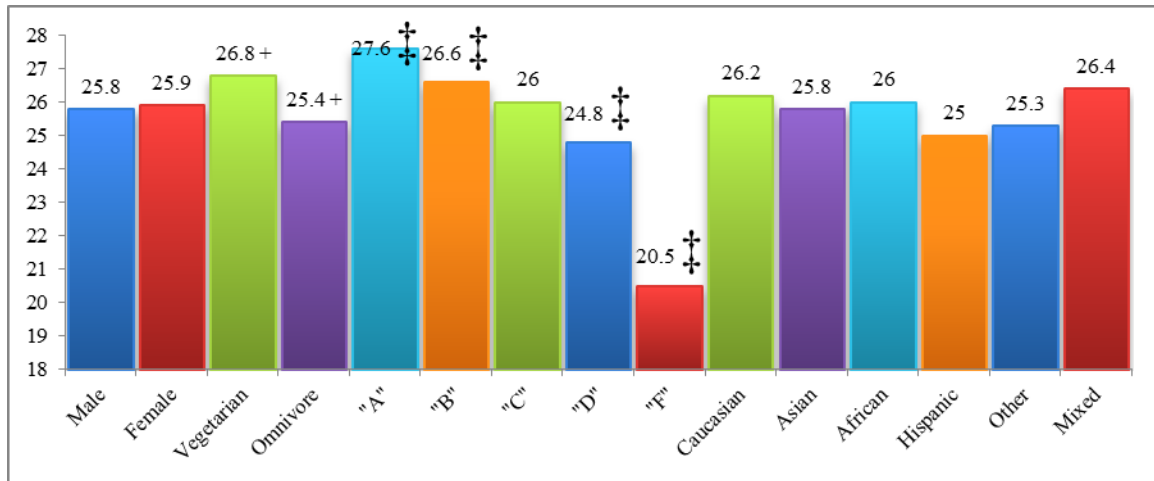


#### 3.2.2. Bacterial Food Safety

The second construct was bacterial food safety, which consisted of five questions, and had a possible score of 5 to 35 on the Likert scale. This was a scale where a high score was a positive view of food safety, and a low score was a negative view of food safety. There was a significant

difference between vegetarians and omnivores, with vegetarians having a more positive view towards bacterial safety than omnivores. Knowledge also placed a role, with attitudes decreasing as the scores decreased.

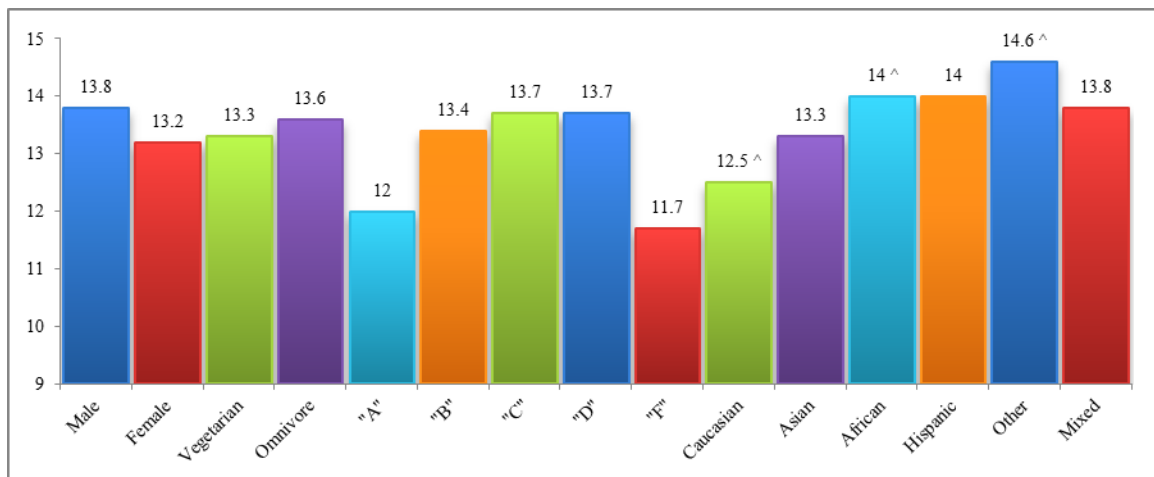
**Figure 2.** Attitudes toward bacterial safety for selected groups



### 3.2.3. Produce Safety

The third construct was produce food safety, which looked at organic food, pesticides, and herbicides, and was composed of three questions with a possible score of 3 to 21. A higher score indicates a more positive view towards produce safety. African Americans and people of other races had a more positive view towards produce safety.

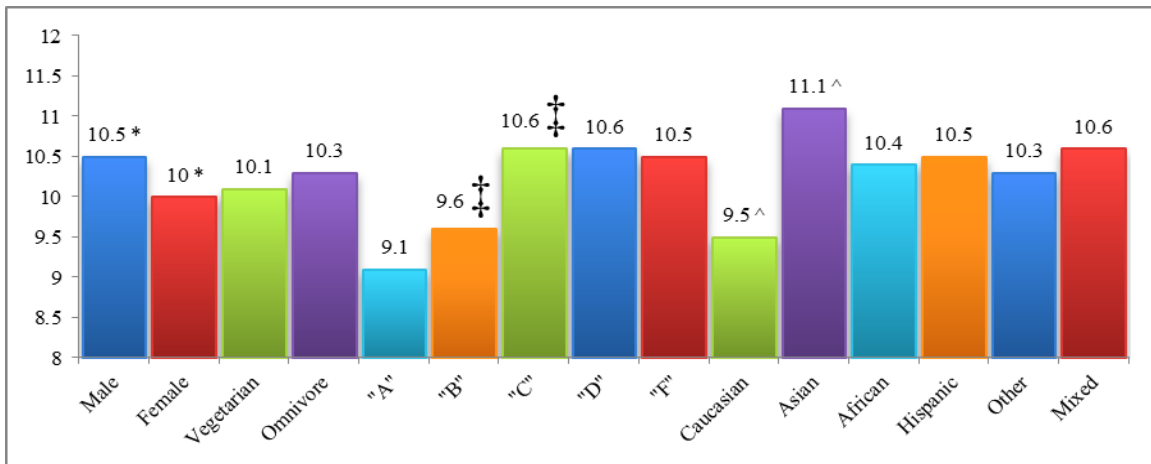
**Figure 3.** Attitudes toward produce safety for selected groups



### 3.2.4. The Politics of Food Safety

The fourth construct was the politics of food safety, which looked at the role of legislation in food safety. There were three questions, with a possible score of 3 to 21. Asians and males had a more positive attitude towards food safety legislation, as well as those who received a “B” or “C” on the knowledge test.

**Figure 4.** Attitudes toward politics of food safety for selected groups



### 3.3. Theoretical Model of the Relationship between General Food Safety, Bacterial Food Safety, Produce Safety, and the Politics of Food Safety

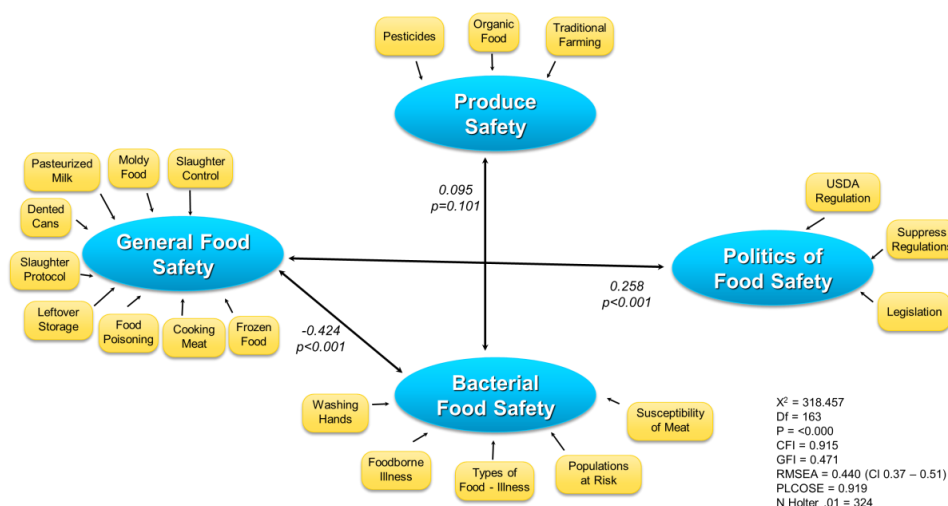
This study examined the underlying concepts that college students have towards food safety using the SEM statistical method. SEM is a powerful multivariate statistical method being used in social sciences, and with increasing frequency in health behavior research [12]. SEM examines the underlying relationships among variables in the model and helps to explain social or behavioral phenomena. Our model was constituted by four sets of concepts: *General Food Safety*, *Bacterial Food Safety*, *Produce Safety*, and *Politics of Food Safety*.

The hypothesized model was assessed by AMOS version 7.0 using the maximum likelihood method. The model was evaluated by four fit measures: **a**, the chi square **b**, the Comparative Fit Index (CFI) **c**, the Good-of-Fit-Index and **d**, the Root Mean Square of approximation (RMSEA).

The results for three out of the four indices support the proposed model. The chi square had a value of 318.457 (Df = 163, n = 499),  $p = 0.000$ , indicating a non-acceptable match between the proposed model and the observed data. However, due to the size of the sample, additional fitted indices were considered. The CFI = 0.915, and GFI = 0.941, both indicate an excellent fit of the model. The RMSEA measures the discrepancy between sample coefficients and the population coefficients equals 0.044 (confidence interval 0.037 – 0.051) indicating an acceptable fitting.

Findings support a model that suggests there is a negative medium correlation between *Bacterial Food Safety* and *General Food Safety* ( $r = -0.424$ ,  $p < 0.001$ ). As attitudes toward general food safety become more extreme, the college student's attitude toward bacterial safety becomes more negative. General food safety is a negative construct, while bacterial food safety was a positive construct. The more likely people were to engage in dangerous food practices, such as eating food from dented cans and drinking unpasteurized milk, the less likely they were to practice bacterial safety, such as washing hands. As attitudes toward *General Food Safety* became more extreme, their attitude toward the *Politics of Food Safety* ( $r = 0.258$ ,  $p < 0.001$ ), or the legislation of food safety became more positive. This may be an indicator that people who have a negative attitude towards general food safety are more inclined to shift responsibility to the government to watch and monitor food safety, instead of doing it themselves.

**Figure 5.** Structural Equation Modeling



### *3.4. Limitations of Study*

Several potential limitations of the study should be considered. This is an observational study which included both genders, and an age group of 18 to 25. This study was conducted on the campus of an American private university, which may limit the generalizability of the results. A large sample size was studied, but some groups might be underrepresented. Although SEM is a sophisticated analytical tool for testing theoretical models in behavioral or social science, the analyses are correlational which makes it difficult to establish causality. Because the isolation of variables in the model is impossible, all models must be looked at as only an estimation of reality.

### **Discussion**

Overall, it appears there are significant differences among people who are vegetarian and have increased knowledge of nutrition. These groups tend to practice more positive general and bacterial food safety. Ethnicity also plays a role in attitudes towards organic food and produce safety, with African Americans having a more positive attitude toward this construct. Asians had a more positive attitude towards legislation in food safety. Knowledge plays a significant role in food safety attitudes.

### **Conclusions**

Knowledge seems to be an important factor in shaping student's attitudes regarding general and bacterial safety. Ethnicity plays a role in how people view the politics of food safety, and perception of the safety of organic food. Nutrition education and food safety education should be encouraged.

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