



## What Implications Does a Baseline of Self-efficacy of Food Safety in Adolescent Populations Have for Future Food Safety Education Interventions?

### ABSTRACT

**P**roperly targeted food safety interventions can change attitudes and behaviors, thus promoting the development of strong self-efficacy of food safety (SEFS). By understanding adolescents' SEFS, interventions could be better designed to target self-efficacy, thus increasing the likelihood of sustainable positive food handling behaviors; however, the baseline level of adolescents' food safety self-efficacy must first be established. The purposes of this study were to: (1) establish a baseline of self-efficacy of food safety in adolescent populations and (2) investigate differences in SEFS by gender, Standard Metropolitan Statistical Areas (SMSA), and food handling experience. Results indicate that adolescents feel confident in their ability to positively impact the safety of their food, with strong self-efficacy in the area of personal

hygiene. Cross-contamination and cooking/cooling temperatures were areas of lowest self-efficacy. There is no evidence to suggest that SEFS is influenced by the number of meals prepared in the home. While there were statistical differences in SEFS by SMSA and gender, low effect sizes indicate that the differences are not practically significant. Developers of future food safety education interventions should focus on providing experiential learning opportunities based on topic areas, not targeting specific demographic groups.

### INTRODUCTION

**G**iven that many consumers still consider food safety as the sole responsibility of food producers, manufacturers, and preparers (5, 10), effective food safety education interventions are critical to combat the approximately 48 million cases of reported foodborne illnesses in the United States every year (8). Effective educational interventions can provide the knowledge necessary to prevent a substantial number of these

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cases (1). In fact, a properly targeted intervention can impact attitudes and behaviors, allowing the target population to recognize their own responsibility for safe food handling (9, 12). Recognition of personal responsibility can promote the development of strong self-efficacy, leading to sustainable behavior changes.

The psychological construct of self-efficacy is the belief in one's own ability to perform tasks and affect outcomes (2, 3) and can predict subsequent motivation and performance (5) relative to specific tasks. Previous studies have shown that high self-efficacy is a strong indicator for individuals who adopt and sustain positive health behaviors and refrain or abstain from negative health behaviors (6, 12). Therefore, educational interventions focused on meaningful behavior change are more successful when they increase participants' self-efficacy (7). This study operationally defines self-efficacy of food safety (SEFS) as the degree to which an individual believes they can affect the safety of their own food.

Adolescents constitute a significant population that has not been fully assessed when it comes to food safety attitudes and self-efficacy, despite the fact that many adolescents have notable food handling responsibilities, both in the home and in the food service sector. Thus, their behaviors are essential in safeguarding the health of consumers (7). Encouraging adolescents' understanding of their responsibility in safe food preparation provides a significant benefit to the population as a whole. To apply this concept effectively so as to bring about sustainable behavioral change in food handling, it is critical to understand the relationships between knowledge, behaviors, and self-efficacy. These relationships are currently unknown in adolescent populations; however, it has been hypothesized that understanding adolescents' self-efficacy of food safety could improve their food handling behaviors (7).

By establishing a baseline of adolescents' self-efficacy of food safety (SEFS), educational and behavioral interventions could be better designed to specifically target self-efficacy, thus increasing the likelihood of sustainable, positive behavior changes. To accomplish that objective, the baseline level of adolescents' food safety self-efficacy needs to be defined and better understood. Therefore, the purposes of this study were to: (1) establish baseline scores for self-efficacy of food safety, and (2) investigate differences that may exist in SEFS by demographic factors (race and gender), SMSA, and food handling experience.

## MATERIALS AND METHODS

### Sample Selection

An a priori analysis determined that a sample size of 400 ( $\alpha = 0.05$ ) was needed to obtain a representative sample of the adolescent population in six southeastern U. S. states: Alabama, Georgia, Kentucky, North Carolina, South Carolina, and Tennessee (11). The population was additionally stratified by three Standard Metropolitan Statistical Areas (SMSA) as defined by the U.S. Census Bureau: Metropolitan,

Micropolitan, and Other (Rural). Within each classification, counties were further stratified by principal cities to ensure a proportionally weighted sample. Each school housing grades 6, 7, or 8 in the six states were entered into a database and classified by SMSA. A random number generator was used to randomly select a total of 105 schools, which were contacted and offered incentives (a class set of microscopes) to participate. A total of 1,125 useable questionnaires were returned from eighteen schools, representing 43% males and 57% females; 73% Caucasian, 15% African American, 6% Hispanic, and 3% Other. Grade level representation was 30% 6th grade, 37% 7th grade, and 30% 8th grade, with a median age of 13. While state curricula varies in health-related content standards, some of which include references to food safety topics such as hand washing, each of the schools in this sample confirmed that they had not been previously targeted for specific food safety education interventions.

### Data collection

Students completed the Self-Efficacy of Food Safety Scale (SEFSS), which measures participants' confidence in one's ability to affect the safety of one's food across six food safety topic areas: personal hygiene (PH), sanitation (SA), cross-contamination (CC), cooking and cooling temperatures (CT), foodborne illness (FI), and high-risk behaviors (RK). Table 1 shows each item classified by food safety topic. The SEFSS contains 12 items rated on a 5-point Likert scale ranging from 'Can't do at all' to 'Can do for sure.' The instrument also included questions about food handling experience and demographic information. A previous study suggests that adolescent food safety self-efficacy can be accurately measured by the SEFSS and demonstrates strong internal consistency, coefficient alpha of .90, and stability across ( $r = .78, P < .001$ ), gender and race,  $F(1, 68) = .977, P = .327$  and  $F(5, 64) = .652, P = .661$ , respectively (3).

### Data analysis

The data were analyzed using descriptive statistics, independent *t*-tests, and analysis of variance (ANOVA). Independent *t*-tests and ANOVAs were used to evaluate group differences within the sample by gender, SMSA, and food handling experience. Tukey HSD post hoc analyses followed for significant test results. The Tukey post hoc test is robust against violation of type I error. Therefore, significant differences were evaluated at  $P < .05$ .

## RESULTS

The purposes of this study were to: (1) establish baseline scores for self-efficacy of food safety and (2) investigate differences that may exist in SEFS by gender, SMSA, and food handling experience. The statistical and practical differences between the six topic areas were explored through paired sample *t* tests and Cohen's *d* measure of effect. *Figure 1* represents the average score for each of the six food safety

**TABLE 1. SEFS items by food safety topic**

Food Safety Topic	SEFS Item
Personal Hygiene (PH)	I can show you how to properly wash my hands.
	I can tell you why washing my hands helps keep me from getting sick.
Sanitation (SA)	I can tell you the difference between cleaning and sanitizing.
	I can tell you how to clean a kitchen to remove germs.
Cross Contamination (CC)	I can show you how to prevent cross contamination.
	I can tell you why it is important to keep cooked foods and raw foods away from each other.
Cooking and Cooling Temperatures (CT)	I can tell you how to correctly measure the temperature of my food.
	I can show you how to store food properly.
Foodborne Illness (FI)	I can tell you why food safety is important.
High Risk Behaviors (RK)	I can reduce the risk of food poisoning.
	I know how to reduce the amount of germs in my food.

topics. The difference between PH and the other 5 topic areas is both statistically and practically significant,  $P < .001$  and  $0.68 < d < 1.45$ , for all comparisons between PH and FI, RK, CC, CT, and SA. FI is lower than PH, but higher than RK, CC, and CT,  $P < .001$  and  $0.52 < d < 0.68$ , for comparisons between PH and RK, CC, and CT, indicating medium effects. RK is lower than PH and FI, and SA  $P < .001$  and  $d = 0.56$ ; however, the differences between RK, CC, and CT are not practically significant. SA is lower than PH, yet higher than both RK and CC,  $P < .001$  and  $d = 0.45$ . Cohen's  $d$  suggests that the practical significance of the difference between SA and CT is small to medium, with  $d = 0.40$ .

**Differences in food safety self-efficacy by SMSA and gender**

Differences in the overall baseline, as well as by food safety topic area, were examined with regard to SMSA and gender. SMSA had a significant impact on SEFS Composite and by food safety topic, with students in Metropolitan areas reporting significantly higher levels of SEFS (Table 1). Students in the Metropolitan Group, as defined by the SMSA, reported significantly higher SEFS than students in both the

Micropolitan and Other (rural geographic locations) SMSA groups,  $F(2, 1122) = 19.24, P < .001, \omega^2 = .03$ . However, omega-squared ( $\omega^2$ ) provides a measure of inferential strength of the test, suggesting that while a statistical difference exists, only 3% of the variance in SEFS may be accounted for by the differences in SMSA,  $t(976) = 1.76, P = .079$ . Significant differences between the genders in overall SEFS or individual topic areas did not exist. While statistically significant test results suggested differences may exist by gender in PH, FI, and SA, the effect sizes, Cohen's  $d < .20$  for all gender  $t$ -tests, suggest little practical significance.

**Impact of food handling experience on SEFS**

When asked how many meals a week participants prepared, 19% indicated preparing 0–1 meals per week, 49% prepared 2–5 meals per week, 22% prepared 6–10 meals per week, and 10% prepared 11 or more meals per week. Food handling experience reported by the participants of this study are consistent with cumulative data collected through Hands On educational programs from a sample of 2,286 students over six years across 11 states. In the current study, no difference was found in food handling experience by SMSA or gender,

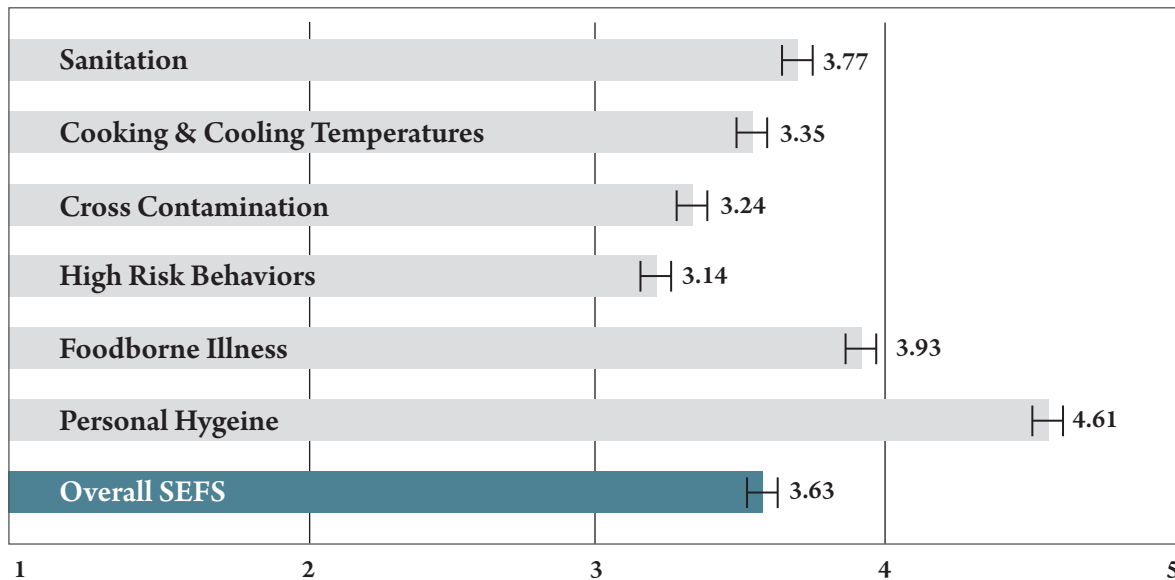


Figure 1. Average response scores for Overall SEFS and by food safety topic

$F(2, 1112) = 0.195, P = .822$  and  $F(1, 1111) = 1.11, P = .292$ , respectively. There is also no evidence to suggest that a person's self-efficacy of food safety is influenced by the number of meals they prepare in the home,  $F(1, 1113) = 0.173, P = .673$ .

## DISCUSSION

The results indicate that adolescents in this sample feel fairly confident in their ability to have a positive impact on the safety of their food. The area of strongest self-efficacy is in personal hygiene (PH), which is likely due to strong and consistent messages students receive beginning in early childhood about the need for and importance of frequent hand washing. Scores were also high in the categories of foodborne illness (FI) and sanitation (SA). Both of these categories focus on the presence of germs, the potential ability of germs to make us sick, and the need to kill germs to prevent illness. Again, these are messages that students receive from an early age and from multiple sources. Therefore, their ability to transfer self-efficacy to food safety concepts is likely increased. Cooking and cooling temperatures (CT), cross contamination (CC), and high risk behaviors (RK) were the categories with the lowest reported self-efficacy, suggesting that these topics are ideal targets for future educational interventions, as they are ones to which adolescents have not had significant exposure or previous personal experience.

Statistically significant differences were found in the SEFS between participants from metropolitan areas and between genders in the topics of personal hygiene (PH), foodborne illness (FI), and sanitation (SA). However, these differences were not practically significant, suggesting that developers of food safety interventions may have greater impact directing

their attention toward raising self-efficacy based on food safety topic areas rather than targeting particular demographic groups. Students of both genders and across all SMSA locations reported high self-efficacy regarding hand washing. This finding is likely a result of intensive messages from a variety of sources regarding the importance of hand washing aimed at students beginning at early ages. Based on the sample in this study, there is no apparent relationship between practical food handling experiences in the home and levels of SEFS. The results of this study also indicated that, while adolescents in this sample feel fairly confident in their ability to have a positive impact on the safety of their food, they need additional opportunities to develop confidence, thereby building self-efficacy, especially in areas of cross-contamination and cooking temperatures.

## CONCLUSIONS AND IMPLICATIONS

It is important to note that this study reports a measure of perceived self-efficacy; it is not a measure of knowledge or behaviors. High SEFS does not necessarily mean that an individual actually understands the concepts or is able to demonstrate positive food handling behaviors. Nor does it provide any indication of the value or level of importance that one ascribes to the behavior. High SEFS does, however, present complex challenges to developers of food safety education interventions. Where perceived SEFS is high, students feel they have already mastered the concept or they lack awareness of the importance of that concept. For example, students with high SEFS in hand washing are likely to be less receptive to additional messages or interventions about that topic because they may feel they have "mastered" the

concept when, in fact, their procedural knowledge and ability to transfer knowledge to positive food safety behaviors may be low. To further impact students' SEFS and acquisition of knowledge, interventions must cause students to challenge their own assumptions of the knowledge and ability to apply that knowledge.

Curiosity and relevance set the stage for acquisition of new knowledge and behavior change (4). Therefore, food safety education interventions, particularly those that target areas of high SEFS, such as hand washing, must pique students' curiosity to encourage new knowledge acquisition. To accomplish this task, education interventions should be directly relevant to students' daily lives, incorporate procedural knowledge, as opposed to a singular focus on declarative knowledge, and allow multiple opportunities for application and higher-ordering thinking. The use of inquiry-based instructional theory embedded in project-based curricula allows for these types of learning environments, giving students the opportunity to practice positive food safety behaviors and not just hear about them.

A needed area of focus for future educational interventions aimed at adolescents is cross-contamination (CC) and cooking temperatures (CT). Given that there is no apparent relationship between practical food handling experiences in the home and levels of SEFS, adolescents may benefit from structured instructional interventions to develop this confidence in cross-contamination and cooking temperatures.

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Again, these interventions should be grounded in inquiry-based instructional theory and provide opportunities for students to gain practical experience performing tasks relating to cross contamination (CC) and cooking temperatures (CT), while promoting direct relevance to daily life tasks.

## Considerations for future research

One of the key priorities of national food safety initiatives is to provide education to at-risk, underserved, or hard-to-reach populations with effective educational interventions designed to change consumers' behaviors so that they adopt safety food handling practices. This study established a baseline of SEFS in adolescent populations. This baseline can now be used as a comparative tool to measure the effectiveness of current and future food safety educational interventions on SEFS. To this end, the researchers will examine SEFS within the context of an existing, validated food safety education intervention for adolescent populations, using the SEFS instrument (3) to determine the extent to which an educational intervention can impact SEFS.

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