THE CHALLENGE OF FOOD SAFETY FOR HEAD START PERSONNEL

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The safety of food consumed by children in today's society is of paramount importance. The outbreak of *Escherichia coli* 0157:H7 in Northwestern United States in 1993 focused society's attention on the issue of safe food. More than 500 laboratory-confirmed illnesses and four deaths occurred during this outbreak" (Marks & Roberts, 1993, p. 1). Food must be safe for consumption, especially food that is eaten by children who are one of society's most vulnerable populations.

In the recently issued 1995 *Food Code*, the Food and Drug Administration (FDA) stated: "foodborne illness in the United States is a major cause of personal distress, preventable death, and avoidable economic burden".

> An estimated 24 to 81 million people become ill from microorganisms in food, resulting in an estimated 10,000 needless deaths every year. The annual cost of foodborne illness is estimated to be between $7.7 and $23 billion. Foodborne illness generally causes only lost time from work or discomfort for most victims. For some, especially preschool age children, older adults in health care facilities and those with impaired immune systems, foodborne illness is more serious and may be life threatening" (Food Code, 1995).

"Food Safety will be the dominant and most thorny issue facing the industry (foodservice) through the rest of the century" (Martin, 1993, p. 75). Even though there are numerous foodborne illness outbreaks reported, more occur that are unreported. Foodborne illness outbreaks go undocumented because consumers are not aware of the symptoms and incorrectly associate foodborne illness symptoms with the flu or colds. The Food and Drug Administration (FDA) updated the food laws of the United States when it issued the 1993 Food Code. This was done to ensure that a new model based on advances in science and reflective of new technologies was in place (Food Code, 1995). It was

revised in 1995 to provide further clarification and incorporate the framework for the application of Hazard Analysis and Critical Control Point (HACCP) principles (Food Code, 1995). The 1995 Food Code highlighted the importance of using a systematic method such as HACCP in order to have adequate controls to prevent foodborne illnesses in foodservice operations. Training of employees and managers regarding food safety was also stressed as a critical element in the foodservice industry.

Food provided to children should not expose them to an increased risk for foodborne illness due to unnecessary hazardous food practices. Several studies have reinforced the importance of providing safe food to children. Albrecht, Sumner & Henneman pointed out "One incident of improper food handling by a child care provider has the potential of affecting many children who are at risk for foodborne illnesses" (1992, p. 740). In a study done in Texas, Briley & Roberts-Gray (1994) stated:

> The demand for child care will continue to grow. It is critical that decisions be made that will ensure that the rising numbers of children who rely on the child care system to provide one or more of the daily meals have opportunities to eat nutritious food that keep them from hunger, promote their proper growth and reinforce choices and habits that are consistent with nutrition principles in the *Dietary Guidelines for Americans*" (p. 281).

It is imperative that children's food be safe and wholesome for consumption while promoting their proper growth and development.

Head Start is a child development program, but must also comply with regulations related to Child Care Centers. The nutrition component of Head Start is supplemented with funding from the Child and Adult Care Food Program (CACFP) whose regulations also apply to Head Start.

Children who participate in Head Start programs are targeted for services due to the high risk conditions they experience. Most children enrolled in Head Start are four years of age and must be economically disadvantaged to qualify. In Marks & Roberts (1993) study of costs associated with *E. coli*, they assumed that all cases that died or developed severe or chronic illness were four years old at the onset of the illness. This was the average age in a

Minnesota study of 117 children under age 18 with severe or chronic illness due to *E. coli* 0157:H7. Additionally, other studies identified children under five years old as a risk factor for *E. coli* disease (Marks & Roberts, 1993, p. 53). Therefore, Head Start enrollees are especially susceptible to *E. coli* due to their age (four years old).

Children enrolled in Head Start usually have other complicating factors such as physical and mental disabilities, barriers to adequate health care, living in single parent homes, educational risk, poor housing conditions and nutrition problems (Administration on Children, Youth and Families, 1995). For these children with special circumstances, Head Start is more than just learning. Its focus is comprehensive and its aim is to make the children socially competent for the future so that they can achieve success, especially in their educational endeavors.

Purpose and Objectives of the Study

The purpose of this study was to determine the food safety knowledge and attitudinal practices of people working with Head Start programs. The specific objectives included:

1. Identify the food safety knowledge and attitudes towards food safety of Head Start workshop participants and relate these with selected personal variables.
2. Determine if their knowledge and attitudinal practices towards food safety principles conformed with accepted standards.
3. Identify food safety training needs for Head Start Program personnel based on the results of the study.

Hypotheses

The following hypotheses were examined.

$H_0$1. There will be no significant associations between food safety attitudinal practices of Head Start workshop participants and selected personal variables: gender,

age, education level, training, years of experience, types of operations and supervisory responsibilities.

H_o2. There will be no significant associations between food safety knowledge of Head Start workshop participants and selected personal variables as listed in H_o1.

H_o3. There will be no significant associations between food safety knowledge and attitudinal practices of Head Start workshop participants.

Assumptions and Limitations

Two assumptions made in this research were:

1. The workshop participants would answer the questionnaire honestly to the best of their ability.
2. The participants were knowledgeable enough about food safety practices to actually answer the questionnaire.

A major limitation in this study was that only a small sample of Head Start personnel attended the regional nutrition workshop in San Antonio, Texas. The subjects who attended the regional nutrition workshop ranged from Head Start personnel involved with the food preparation and service at local centers, to those responsible for the overall administration of the Head Start Programs in their districts. Even though this was not a random sample, the subjects had diverse backgrounds and worked at locations throughout the Southwest region of the United States.

Definitions

The following terms were defined so that the researcher's meaning is specifically understood.

"Critical Control Points (CCP) are those processing determiners whose loss of control would result in an unacceptable food safety risk" (Bauman, 1974, p. 30).

Critical Limit, as defined in the Food Code, means the maximum or minimum value to which a physical, biological, or chemical parameter must be controlled at a critical control point to minimize the risk that the identified food safety hazard may occur" (Food Code, 1995, p. HACCP 2).

Cross Contamination is either direct or indirect from a contaminated food to other foods.

a.) "Indirect cross contamination occurs when a contaminated (e.g. raw) food is handled by persons or when it contacts surfaces of utensils or equipment , and subsequently the contaminated hands of the person or surface contacts a previously uncontaminated or cooked food. Since cross contamination is a series of sequential events, it occurs over time; hence it is difficult to detect during routine inspections of short duration or during retrospective epidemiologic investigations" (Bryan, 1988, p. 669).

b.) Direct Contamination occurs when the contaminated hands of a person handles uncontaminated food or sneezes/coughs directly on the food .

"Foodborne Disease Outbreak is defined as an incident in which 1) two or more persons experience a similar illness after ingestion of a common food, and 2) epidemiologic analysis implicates the food as the source of the illness. A few exceptions exist: for example, one case of botulism or chemical poisoning constitutes an outbreak" (Centers for Disease Control, 1990, p. 16).

Foodborne infections are illnesses "caused by the activity of a large number of bacterial cells carried by the food into the gastrointestinal system of the victim" (Spears, 1995, p. 426).

Foodborne intoxications are outbreaks of acute gastroenteritis "caused by toxins formed in the food prior to consumption" (Spears, 1995, p. 426).

"Hazard means a biological, chemical, or physical property that may cause an unacceptable CONSUMER health risk" (Food Code, 1995, p. 9).

"Hazard Analysis and Critical Control Points (HACCP) is a preventive system for quality control, designed to inform management of potential dangers so that corrective action can be taken; emphasis is on microbiologic control" (Bobeng & David, 1978, p.524).

Head Start is a federally funded, early child development program, serving low income children and their families. "Head Start was originally designed to serve as a model of comprehensive services including health, education, parent involvement and social services" (National Head Start Association, 1990, p. 34).

"Highly Susceptible Population means a group of PERSONs who are more likely than other populations to experience foodborne disease because they are immunocompromised or older adults and in a facility that provides health care or assisted living services, such as a hospital or nursing home; or preschool age children in a facility that provides custodial care, such as a day care center" (Food Code, 1995, p. 9).

Potentially Hazardous Food means a

(a) FOOD that is natural or synthetic and is in a form capable of supporting:
  (i) The rapid and progressive growth of infectious or toxigenic microorganisms;
  (ii) The growth and toxin production of *Clostridium botulinum*; or
  (iii) In shell eggs, the growth of *Salmonella enteritidis*.

(b) Potentially hazardous food includes an animal FOOD (a FOOD of animal origin) that is raw or heat-treated; a FOOD of plant origin that is heat-treated or consists of raw seed sprouts; cut melons; and garlic and oil mixtures.

(c) Potentially hazardous food: does not include:
  (i) An air-cooled hard-boiled egg with shell intact;
  (ii) A FOOD with a WATER ACTIVITY (AW (A_W)) value of 0.85 or less;
  (iii) A FOOD with a hydrogen ion concentration (PH (pH)) level of 4.6 or below when measured at 24°C (75°F);
  (iv) A FOOD, in an unopened HERMETICALLY SEALED CONTAINER that is commercially processed to achieve and maintain commercial sterility under conditions of nonrefrigerated storage and distribution; and
  (v) A FOOD for which a variance granted by the REGULATORY AUTHORITY is based upon laboratory evidence demonstrating that rapid and progressive growth of infectious and toxigenic microorganisms or the slower growth of *C. botulinum* cannot occur (Food Code, 1995, p. 9).

Virus is defined as "Disease producing agent smaller than the ordinary germ; consists of a nucleic acid, either RNA or DNA, enclosed in a protein layer. It is a living pathogen that can multiply only in the presence of living, healthy host cells" (Claudio & Lagua, 1991, p. 245 & 246).

CHAPTER II

REVIEW OF LITERATURE

Introduction

A brief historical review of Head Start will be covered in this chapter. Other major areas reviewed encompassed foodborne illness, food safety and other research.

Head Start

Head Start evolved from the War on Poverty, which was declared by President Lyndon Johnson in 1964 with the establishment of the Economic Opportunity Act. The Economic Opportunity Act of 1964 had various aspects including: 1) The Job Corp, whose purpose was to provide education and training for employment, 2) The Community Action Program, whose objective was to mobilize the poor themselves to fight poverty, and 3) VISTA, a domestic Peace Corps (Zigler & Valentine, 1979).

By the middle of 1965, the Office of Economic Opportunity (OEO) had spent approximately 9% of its 300 million dollar appropriation with expectations of spending only half by the end of the year (Zigler and Muenchow, 1992). The director of OEO, Sergeant Shriver, was concerned about utilizing the surplus funds and a study was undertaken by OEO's research division to investigate the complete problem of poverty and provide recommendations for putting the surplus funding to good use. The research division found that almost half of the nation's 30 million poor people were children. This large number of poor children led Shriver to believe that it was imperative to do something about children in order to attack the War on Poverty (Zigler & Valentine, 1979).

Shriver recalled studies funded by the Kennedy Foundation which showed early intervention with high risk children and their families could raise IQ scores and that good nutrition in early life could affect mental development. When Shriver was President of the Chicago School Board, it came to his attention that children living in the slums had numerous obstacles to face. He thought their chances in life could be greatly improved by preschool exposure to "books, teachers, desks, pencils, chalk and school buildings" (Zigler & Valentine, 1979, p. 53). Shriver's idea was to prepare poor children for first grade and provide proper food, immunizations, and medical examinations to uncover hearing and vision problems. By doing, so he hoped to alleviate barriers to learning. Shriver discussed the idea of a preschool program with numerous scientists and experts in children's services, including his family pediatrician, Dr. Robert Cooke. The experts consulted by Shriver were supportive of the program and Cooke and members of the OEO staff enlarged the preschool program idea further than an approach based purely in academics (Zigler & Muenchow, 1992). Cooke chaired a Head Start planning committee in December of 1964 and the comprehensive scope of Head Start was determined by the committee's very composition. The committee included two early childhood educators, four physicians, a professor of nursing , an associate dean of social work, a nun who was a college president, a dean of a college of education, a clinical psychologist and two research psychologists (Zigler & Valentine, 1979)

"The fundamental idea behind Head Start was to get kids ready so they would have a chance in school and a chance in school would give them a chance in life" (Zigler & Valentine, 1979, p. 59). Head Start was based on the American Dream--that education is the key to a better life. Schorr (1988) stated: "By midsummer of 1965, Head Start was helping half a million poor children and their families--in some measure-- to overcome physical, intellectual, and social impediments to a successful start at school" (p. 184). In 1965, Head Start served 561,000 children and utilized a budget of $96.4 million dollars for the summer program (Schorr, 1988).

The success of the Head Start program comes from key requirements built into the program such as parent involvement, health professional connection through screenings and examinations, and matching government funds with 25% in-kind donations of labor or goods. In addition to preparing children for their educational endeavors, Head Start has a strong guiding principle of training staff and parents. "Head Start has a positive impact on the training and employment of parents and more than one-third of Head Start staff are current or former Head Start parents" (Administration on Children, Youth and Families, 1994).

Throughout the span of Head Start, less expensive methods were always sought to prepare children for school. During the same period, *Sesame Street* experienced great popularity and reached children from all types of backgrounds. When Zigler was asked to utilize Head Start funds to assist with funding *Sesame Street*, he asked "How long would a poor child have to watch Sesame Street to get his or her teeth filled?" (Zigler & Muenchow, 1992, p. 165). This comprehensive philosophy, which included aspects of child development besides education, was the element that set Head Start apart from other pre-school programs.

The Head Start of today's world is dramatically different than in 1965. The needs of families and children in the 1990's who live in poverty, are more complicated and urgent than any time previously. The continued need for Head Start still exists because the face of poverty has changed to include more single parents as well as increasing numbers of working parents, as shown by the following data from the Administration on Youth and Families, 1994:

- More than 5 million children under the age of three are in the care of other adults while their parents work.
- One in four infants and toddlers under the age of three (nearly 3 million children) live in families with incomes below the poverty level.
- Children are increasingly likely to live with just one parent, usually the mother; in 1960, fewer than 10 percent of all children under the age of eighteen lived with one parent; by 1992, almost 27 percent of all children lived with one parent.

- In 1960, only 5 percent of all births in the United States were to unmarried mothers; by 1990, the proportion had risen to 28 percent. About every minute, an American adolescent has a baby; every year, about 1 million adolescents become pregnant.
- Today, we also have new knowledge about the services and supports that are most effective in changing long-term outcomes for young children, as well as new knowledge about the importance of the first three years of life (p. 2).

Parent and community involvement represent the cornerstone which has made Head Start one of the most successful preschool programs in the country. The major components of Head Start include: (1) education, (2) health, (3) parent involvement, and (4) social services (Novello, 1994). These services are designed to meet the needs of each child, the community, and its ethnic and cultural characteristics. Early identification of health problems is emphasized in Head Start and every child is involved in a comprehensive health program which includes immunizations, medical, dental, mental health, and nutritional services. Parents are involved in every aspect of the Head Start program. Some serve on policy councils, most attend classes and workshops on child development and all receive staff visits to the home which allow the parents to learn about the needs of their children and educational activities that can be accomplished at home (Administration on Children, Youth and Families, 1994).

The emphasis on training of staff and parents developed when Head Start began because there was a great need to have staff who were competent to care for the children involved. From this need emerged the Child Development Associate (CDA) credential, a competency based credential (Zigler, 1992, p. 117). Staff at all levels and in all program areas receive training. The Child Development Associate (CDA) program gives professional and non-professional personnel the chance to pursue academic degrees or certification in early childhood education. Currently, there are over 55,000 CDA's in the USA and many have a bilingual specialization.

Volunteers play an essential role in Head Start programs. All kinds of people provide help to local Head Start programs. Volunteers assist with: indoor creative play, transportation, parent education, renovation of centers, and recruitment and instruction of

other volunteers. "Approximately 1,157,000 individuals volunteer, and community organizations provide a wide array of services to Head Start, including the donation of classroom space, educational materials, and equipment for children with disabilities" (Administration on Children, Youth and Families, 1994).

Head Start provides an excellent model in focusing attention on the importance of early childhood development. In addition, Head Start provides parents with numerous opportunities to improve their parenting skills and increase their knowledge of child development through training, home visits, workshops, meetings, and service on policy council. The program determines the standard for child development and day care service; encourages expansion of state and local activities for children, and augments the range and quality of services offered to young children and their families.

Project Head Start has stood the test of time and in the fiscal year 1994, 740,493 children were enrolled and the program with an annual budget of $3.3 billion dollars. The program provides services to children from birth through age five and older, and children attend Head Start for a half day or a whole day that corresponds with the local school calendar. Additionally, some children are served in their homes by the Head Start programs versus attendance at a center.

The majority of children involved in Head Start are four year olds (62%) with three year olds making up the next largest group (28%) and five year olds about 7%, while those younger than 3 years of age comprise about 3% of the remainder of clients. A total of 14,594 million children have been served by the program since it began in 1965. During the 1993-94 operating period, Head Start programs reported the following :

- 66% of Head Start families have incomes of less than $9,000 per year
- 83% have yearly incomes of less than $12,000.
- 13% of the Head Start enrollment consists of children with disabilities.
- 30.5% of the staff are parents of current or former Head Start children
- 69% of the Head Start children are enrolled in the Medicaid/Early Periodic Screening Diagnosis and Treatment (EPSDT) program which pays for their medical and dental services (Administration on Children, Youth and Families, 1995, p. 4).

Table I details the total dollars allocated for Head Start in fiscal year 1994 to the states involved in this study. Additionally, the number of children enrolled in the program for each state is shown.

TABLE I

FY 94
STATE ALLOCATIONS AND ENROLLMENT
OF STATES INVOLVED IN STUDY

Location of Programs	Funding Dollars	Children Enrolled
Texas	$213,394,321	51,521
American Indian*	$ 90,793,074	18,738
Louisiana	$ 75,876,200	9,344
Oklahoma	$ 39,073,258	11,165
Arkansas	$ 30,718,819	9,065
New Mexico	$ 24,240,691	6,397
South Dakota	$ 7,984,880	2,025

*Indian Tribal Organizations throughout the United States
(Administration on Youth and Families, 1995, p. 5 & 6)

The average age of the population being served by Head Start, mostly three and four year olds, are vulnerable to foodborne illnesses because their immune systems are not fully developed. Recognition of the clinical signs of foodborne illness is essential for caregivers of children. These symptoms include diarrhea, nausea, vomiting, and dehydration. The threat of dehydration caused from diarrhea and vomiting is of great concern in children since dehydration can occur rapidly and put their life at risk. Selected foodborne illnesses may have exceptionally bad outcomes including organ failure and/or death (Ollinger-Snyder & Matthews, 1996). Therefore, it is imperative that the staff providing and serving meals to this highly susceptible population be knowledgeable and well trained about food safety and prevention of foodborne illness. The position of the American Dietetic Association regarding nutrition standards for child care programs was issued in 1986, reaffirmed in 1993, and effective until October, 1998. The position is

stated as follows: *It is the position of The American Dietetic Association (ADA) that all child care programs should achieve recommended standards for meeting children's nutrition and education needs in a safe, sanitary, supportive environment that promotes healthy growth and development* (Briley & Roberts, 1994, p. 323). Food that is safe to consume is required for all humans and essential for the growth and development of children. Head Start's purpose is to improve the health and nutrition status of children, and not cause them to suffer due to a foodborne illness.

Foodborne Illness

"An estimated 24 to 81 million people become ill from microorganisms in food, resulting in an estimated 10,000 needless deaths every year" (Food Code, 1995, p. i). The costs of these illnesses are hard to determine but estimates range from $7.7 to $23 billion dollars (Food Code, 1995). It is very difficult to put specific value to lives lost when deaths occur due to foodborne illness. Foodservice personnel, especially those who provide food to highly susceptible populations such as children, elderly, and immune compromised people have an immense obligation to perform their duties in an exceptional manner to prevent foodborne illness. The foodservice workers must be knowledgeable about prevention of foodborne illnesses, committed to serving safe foods, and be responsible in their work habits to avoid the serious consequences of a foodborne outbreak.

There are different types of hazards that must be prevented from contaminating food. These include: (1) microbiological, (2) chemical and (3) physical hazards. Microbiological hazards include: (1) Bacteria, (2) Viruses (3) Parasites (4) Fungi (yeasts & molds). Chemical hazards include: (1) chemicals that contaminate food products such as detergents, cleaning agents, etc., (2) acidic food in metal lined containers, (3) excessive quantities of additives pesticides, nitrate, and (4) toxic metals, (lead poisoning).

Examples of physical hazards are: metal objects, wires, broken glass, shavings from cans, hair, and dust, or dirt (Byers, Shanklin, & Hoover, 1994).

Discussion of microbial hazards

There are four major groups of microbiological hazards, and bacteria, which is the most abundant, is usually divided into pathogens and toxins. Common pathogens include *Salmonella, Listeria monocytogenes,* and *Clostridium perfringens.* Some bacteria releases toxins. A few well-known toxins are produced by *Bacillus cereus* and *Clostridium botulinum.* (Byers, et al., 1994)

Bacteria spreads easily and attaches itself to human hair, skin, scars, under fingernails and on clothing. Bacteria is also present in mucous membranes in the nose, mouth , throat and also in the intestinal tracts of humans and animals. To prevent bacterial growth, various key elements must be controlled or eliminated: (1) oxygen, (2) food, (3) water (moisture), (4) heat/cold (temperature), (5) acidity/alkalinity of environment, (6) time available for reproduction, and (7) presence or absence of inhibitors. The time between preparation and service is critical because that is when contamination usually occurs. Potentially hazardous foods should not remain in the temperature danger zone (41° to 140°F) (5° to 60°C) for more than four hours during the entire foodhandling process" (Armstrong, 1995, p. 17). A representation of the temperature danger zone has been included in Appendix C (Byers et al., 1994, p. 302).

The Servsafe training program developed by the National Restaurant Association uses the acronym FATTOM to assist people in remembering the key elements that must be prevented, controlled or eliminated to prevent bacterial growth (Figure 1) (Armstrong, 1995, p. 17). The acronym stands for Food, Acid, Time Temperature, Oxygen, and Moisture (Armstrong, 1995, p. 17).

These conditions can be remembered by the acronym FAT-TOM:

F	**Food**	High-protein foods are likely to be received already contaminated or may be easily contaminated later.
A	**Acidity**	Acidity is measured on a scale from 0 (very acid) to 14.0 (very alkaline [basic]). A solution with a pH (acid-alkaline measurement) of 7.0 is neutral. Most potentially hazardous foods have a pH level between **4.6 and 7.0** (see *Exhibit 2.3*). However, high acid foods, such as citrus fruit, rarely allow the growth of harmful bacteria. Adding vinegar or lemon juice to food items will help slow bacterial growth—but it does not ensure control and should not be used as the only defense against bacterial growth.
T	**Time**	Potentially hazardous foods should not remain in the temperature danger zone (see **Temperature**) for more than **four hours** during the entire foodhandling process.
T	**Temperature**	The *temperature danger zone** for potentially hazardous foods is **40° to 140°F (4.4° to 60°C)** (see *Exhibit 2.4*). However, since bacteria can survive at (and some bacteria can grow at) lower temperatures, refrigerating food is not total protection against bacterial growth. Discard food if it is past its expiration date.
O	**Oxygen**	Some bacteria require oxygen to grow, while others require no oxygen. However, most of the bacteria that cause foodborne illness can grow either with or without oxygen.
M	**Moisture**	The amount of available water in food is called the *water activity* (A_w). The lowest A_w at which harmful bacteria will grow is **0.85**. Most potentially hazardous foods have water activity values of 0.97–0.99, which is ideal for bacterial growth (see *Exhibit 2.5*). Water activity can be reduced to safer levels by freezing, dehydrating (removing the water), adding sugar or salt, or cooking. Dry foods, such as beans and rice, become potentially hazardous when water is added.

* The FDA's *1993 Model Food Code* states that the temperature danger zone is **41° to 140°F (5° to 60°C)**. Some health codes specify **45° to 140°F (7.2° to 60°C)**, while other codes use **40° to 140°F (4.4° to 60°C)** as the temperature danger zone. Check with your local jurisdiction to find out what temperatures are accepted.

Figure 1: Acronym for Preventing Bacterial Growth
(Source: Armstrong, 1995, p. 17)

Emerging Pathogens

In the United States, most foodborne illnesses are linked to four widely recognized pathogens: *Staphylococcus aureus,Salmonella, Clostridium perfringens*, and *Bacillus cereus*. "Several other pathogens, often referred to as emerging pathogens, have been identified as important causes of foodborne illness" (Byers, et al., 1994, p. 307). Those that concern the foodservice industry include: *Campylobacter jejuni, Listeria monocytogenes*, Norwalk virus, and *enterohemorrhagic Escherichia coli* 0157:H7. These organisms are usually transported through contaminated water, manure, humans, or they can contaminate food products during processing.

Campylobacter jejuni frequently contaminates food of animal origin because it is present in the intestinal tracts of cows, pigs, sheep and poultry. Most outbreaks involving *Campylobacter jejuni* are caused by unpasteurized milk or contaminated water. Foodborne outbreaks have also been tied to raw or undercooked meat or poultry or being re-contaminated through exposure after cooking. *C. jejuni* is susceptible to heat, acidic conditions, and temperatures below 30°C, (86°F), and can be destroyed through proper food handling practices.

"*Listeria monocytogenes* has been classified as a human pathogen for more than 60 years. The importance of food as a transmission vehicle has been identified only in recent years" (Byers, et al., 1994, p. 309). Vulnerable population groups are at high risk for contamination by this pathogen. It is commonly found in soft cheeses, raw soil-grown vegetables, unpasteurized milk, raw meat and poultry. "Listeria is especially troublesome because it can grow, albeit slowly, at refrigeration temperatures" (Cooke, 1990, p. 792). Good food handling procedures must be adhered to for prevention of outbreaks of *L. monocytogenes*.

Norwalk Virus is caused by inferior personal hygiene habits among food handlers infected with the virus, which is then transmitted through contaminated water supplies and human contact. It is also found in raw vegetables fertilized with manure, eggs, shellfish,

coleslaw, frozen foods, and manufactured ice cubes. It does not reproduce in food because it is a virus, but it does remain active . Control of Norwalk Virus is hard to achieve because it withstands freezing temperatures and chlorine sanitizing solution--however, it is susceptible to high temperatures (Byers, et al., 1994).

Enterohemorrhagic Escherichia coli 0157:H7 (*E. coli*) was first identified in 1982 (Byers, et al., 1994). It is a nonspore-forming facultative bacterium and numerous food-related outbreaks have been caused by it. The bacteria can cause hemorrhagic colitis (bloody diarrhea) and renal failure (hemolytic uremic symptoms) (Byers, et al., 1994). Foods that have been implicated in the spread of this bacteria include: undercooked or raw ground beef, red meat and unpasteurized milk. To avoid fecal contamination during slaughtering, good food-manufacturing practices should be followed.

Additional emerging pathogens include: *Salmonella enteritidis*, *Vibrio parahaemolyticus* and *Yersinia enterocolitica*. (Byers, et al., 1994). Outbreaks involving these particular pathogens are reported less frequently but can also be avoided or significantly reduced if food handlers utilize the proper food handling practices. The 1995 Food Code provided an "assessment of severity of the biological hazards which may be associated with food being prepared, served, or sold in food establishments" (p. HACCP 6 & 7). These biological hazards are presented in Appendix D.

Hazard Analysis and Critical Control Points (HACCP)

Hazard Analysis and Critical Control Points (HACCP) is a comprehensive system designed to prevent foodborne illness outbreaks by examining the total food service operation from procurement through service. HACCP is considered to be state of the art by regulatory bodies and the food industry in monitoring and controlling the safety of the food supply. Comprehensive HACCP programs detect critical control points and after identification the hazard can be eliminated or reduced (Food Code, 1995).

In a recently released study of the Schwan ice cream outbreak which occurred in 1994, it was determined that "low-level contamination of foods by salmonella, and thus extremely low infectious doses, can cause disease in humans (Hennessy, Hedberg, Slutsker, White, Besser-Wiek, Moer, Feldman, Coleman, Edmonson, Macdonald,Osterholm & the Investigation Team, 1996, p. 1285). The researchers additionally state that "many current quality-assurance programs appear to be inadequate in detecting very low levels of contamination" (Hennessy, et al., 1996, p.1285). They suggest that "improved techniques are needed in the food industry to ensure product safety" (Hennessy, et al., 1996, p.1285).

Bobeng and David statde that the "HACCP system is a preventative program for quality control designed to inform management of potential dangers so that corrective action can be taken" (1977, p. 633). In an earlier publication, Bauman (1974) said that the purpose of developing the HACCP approach was to apply a zero-defects concept to production of food, taking into consideration ingredients, processing steps, and potential for consumer abuse (p. 30). Bauman (1974), credited the National Aeronautics and Space Administration (NASA), The Pillsbury Company, and the U. S. Army Natick Laboratories for the development of the HACCP concept.

In HACCP models for foodservice systems, four critical control points have been distinguished: (1) ingredient control and storage, (2) equipment sanitation, (3) personnel sanitation, and (4) time-temperature relationships. The 1995 Food Code lists seven major principles of HACCP. They are: (1) hazard analysis (2) identify the critical control points in food preparation (3) establish critical limits for preventive measures (4) establish procedures to monitor critical control points (5) establish the corrective action to be taken when monitoring shows that a critical limit has been exceeded (6) establish effective record keeping systems that document the HACCP system and (7) establish procedures to verify that the HACCP system is working (Appendix E) (Food Code, 1995, p. HACCP 5-HACCP 23)

Control of ingredients is achieved through specifications that state the desired sensory characteristics and quantity of the food item, and the microbiological count. Specifications may also cover the type of packaging and time-temperature parameters during transportation. All food must be procured from supplier who are in total compliance with laws related to food, food labeling and distribution.

Upon delivery of food, meticulous inspections should be conducted to ensure compliance with food specifications. Provisions should be visually checked, counted, and weighed. Additionally, food temperatures of refrigerated and frozen food should be recorded. Any items that do not meet specifications should be rejected. Frozen and refrigerated items should be stored promptly under suitable conditions.

Proper care during food storage prevents or controls loss or waste due to deterioration or infestation. Ingredients must be checked frequently to determine if quality had deteriorated or microbial spoilage has occurred. Appropriate temperature-time relationships during storage are also necessary. Dry goods should be protected from infiltration from insects and rodents and bacterial contamination. The dry storage areas should be at 50°F to 70°F (10°C to 21°C), well-ventilated, and dry (Byers, et al. 1994).

Temperatures of food requiring refrigeration and considered to be potentially hazardous should be 41°F(5°C) or below (Food Code, 1995 p. 57). Accurate thermometers must be utilized in refrigeration/freezer units. Additionally, foodservice staff need to be diligent in preventing cross-contamination of raw and cooked food during refrigerated storage. Frozen foods must be stored at 0°F (-18°C) or below and should be packaged in materials which are impermeable to moisture and oxygen (Byers et al., 1994).

Inadequate equipment sanitation and cross contamination were reported by Bryan (1994) as two major factors contributing to foodborne disease outbreaks. In many outbreaks of foodborne illness, the sinks, knives, cutting boards, and hands were common links between contaminated fresh foods and cooked food.

Where food is handled, the personal sanitation of those working with the food is a critical control point. Handwashing has been an effective way to prevent contamination and the 1995 Food Code stated:

> Handwashing
> Food employees shall clean their hands and exposed portions of their arms with a cleaning compound in a lavatory that is equipped as specified ... by vigorously rubbing together the surfaces of their lathered hands and arms for at least 20 seconds and thoroughly rinsing with clean water. Employees shall pay particular attention to the area underneath the fingernails and between the fingers Additionally it listed specific times when hands should be washed and required washing hands twice after using the restroom (p. 27 & 28).
>
> (A) Food employees shall wash their hands as specified under section 2-301.12 and 2-301.13.
>
> (B) Except when washing fruits and vegetables as specified under section 3-302.15, food employees may not contact exposed, ready-to-eat-food with their bare hands and shall use suitable utensils such as deli tissue, spatulas, tongs, single use gloves or dispensing equipment.
>
> (C) Food employees shall minimize bare hand and arm contact with exposed food that is not in a ready-to-eat form.
>
> Single -Use Gloves
> If used, single-use gloves shall be used for only one task such as working with ready-to-eat food or with raw animal food, used for no other purpose, and discarded when damaged or soiled, or when interruptions occur in the operation (p. 48).
>
> Hair Restraints
> Food employees shall wear hair restraints such as hats, hair coverings or nets, beard restraints, and clothing that covers body hair, that are designed and worn to effectively keep their hair from contacting exposed food; clean equipment, utensils, and linens; and unwrapped single-service and single-use articles (p. 30 & 31).

People may contaminate the food directly or indirectly. "For each year from 1983 to 1987, the most commonly reported food-preparation practice that contributed to foodborne disease was improper storage or holding temperature, followed by poor personal hygiene of the food handler" (Centers for Disease Control, 1990 p. 23).

Abuse of the of the time-temperature relationships in food handling have frequently contributed to foodborne disease outbreaks (Bryan, 1974). Some factors that have been identified are inadequate refrigeration, preparing foods far in advance of planned service with improper storage during the interval before serving, inadequate heat processing, and

holding foods in warming devices at temperature that favor bacterial growth. The following standards regarding temperature and time were taken from the 1995 Food Code:

RECEIVING

Refrigerated, potentially hazardous food shall be at a temperature of 5°C (41°F) or below when received (p. 37).

THAWING

Potentially hazardous food shall be thawed:

(A) under refrigeration that maintains the food temperature at 5°C (41°F), or below;

(B) Completely submerged under running water

(1) at a water temperature of 21°C (70°F) or below;

(2) With sufficient water velocity to agitate and float off loose particles in an overflow and

(3) For a period of time that does not allow thawed portions of ready-to-eat food to rise above 5°C (41°F), or

(4) For a period of time that does not allow thawed portions of a raw animal food requiring cooking ...to be above 5°C (41°F) for more than 4 hours including the time the food is exposed to the running water and the time needed for preparation for cooking or the time it takes under refrigeration to lower the food temperature to 5°C (41°F) (p. 57 & 58).

COOKING (3-401.11)

Except as specified in B and C of this section, raw animal foods such as eggs, fish, poultry, meat and foods containing these raw animal foods, shall be cooked to heat all parts of the food to a temperature and for a time that are at least:

(1) 63°C (145°F) or above for 15 seconds for

(a) Shell eggs that are broken and prepared in response to a consumer's order and for immediate service, and

(b) Fish and meat that are not specified in Subparagraph (A) (2) of this section;

(2) For pork , and exotic species of game animals, comminuted fish and meats (comminuted means reduced in size by methods including chopping, flaking, grinding, or mincing- p. 3), injected meats, and eggs that are not prepared as specified in Subparagraph (A) (1) (a) of this section, 68°C (155°F) for 15 seconds or the temperature specified in 3-401.12 that corresponds to the cooking time.

(3) As specified in section 3-401.14 (table on p. 54 of 1995 Food Code) for roasts of beef and corned beef; or

(4) 74°C (165°F) or above for 15 seconds for wild game animals as specified in Subparagraphs 3-201.17 (C) and (D), poultry, stuffed fish, stuffed meat, stuffed pasta, stuffed poultry, or stuffing containing fish, meat, or poultry.

REHEATING

Potentially hazardous food that is cooked, cooled and reheated for hot holding shall be reheated so that all parts of the food reach a temperature of at least 74°C (165°F) for 15 seconds.

COOLING

(A) Cooked potentially hazardous food shall be cooled:

(1) From 60°C (140°F) to 21C (70°F) within 2 hours; and

(2) From 21°C (70°F) to 5°C (41°F), or below, within 4 hours.

(B) Potentially hazardous food shall be cooled to 5°C (41°F) or below within 4 hours if prepared from ingredients at ambient temperature, such as reconstituted foods and canned tuna.

(C) A potentially hazardous food received in compliance with laws allowing a temperature above 5°C (41°F) during shipment from the supplier shall be cooled to 5°C (41°F) or below within 4 hours (p. 58).

The temperature of entrees during hot holding in the conventional cook serve system should be at least 60°C (140°F). "Temperature measuring devices (such as thermometers or thermocouples) shall be calibrated in accordance, with manufacturer's specifications as necessary to ensure their accuracy." The storage facility for hot holding must be equipped with an accurate food thermometer. "Since hot holding equipment is designed to maintain rather than increase temperature of food, entree temperature should be higher than 60°C (140°F) at the onset of hot holding" (Bobeng & David, 1977, p. 636). Bryan, (1990) discussed that "failures to hold foods hot have frequently contributed to outbreaks of foodborne disease in foodservice establishments and are a great potential for causing outbreaks in fast-food restaurants, cafeterias, and food-market delis where cooked foods are held hot, or sometimes only warm, for long duration" (p. 981).

It was emphasized by Peterson and Gunnerson (1974) that results of microbiological analyses are obtained too late to be useful for the lot being tested. They also stressed the importance of anticipating and preventing microbiological problems in the HACCP system and "stated that much of in-process control consisted of maintaining time-temperature standards and may involve continuous surveillance" (p. 43).

The future holds faster techniques for detection of microbiological hazards. These techniques, instruments and systems either complement traditional methods or replace current systems with rapid detection of microorganisms. "Several commercially available instruments and systems are designed to simplify conventional culturing techniques" (Giese, 1995, p. 64). Two rapid detection tests that have been researched include PATH-STIK for the detection of *Salmonella* (Brinkman, Van Beurden, MacKintosh & Beumer,

1995) and Dynabeads Anti-*Salmonella* (Holt, Gast & Greene, 1995, p. 967). Improved monitoring for foods using time-temperature strips is another technological advance that can aid foodservice operators.

When putting a HACCP system to work, inspection of critical control points (CCP's) needs to be documented. A decision tree has been included in Appendix F to verify which food preparation steps should be designated as CCPs (Appendix F). The foodservice administration of the future may be required to file reports of food safety self-inspection with state or local regulatory officials. Inspections may be based on the HACCP plan and monitoring it's implementation.

Prevention of Foodborne Illness Outbreaks

The avoidance of foodborne illness outbreaks is essential in order to prevent sickness and death especially among vulnerable population groups. Costs associated with foodborne illness are hard to determine accurately. Marks and Roberts reported that USDA's Economic Research Service (ERS) estimated the medical costs and productivity losses from E. coli O157:H7 to range from $216 million to $580 million annually (1993, p. 52). "This places it as the fourth most costly foodborne diseases for which the EPS has estimated costs, behind one parasite (*Toxoplasma gondii*) and two bacteria (*Salmonella* and *Campylobacter*)" (Marks & Roberts, 1993, p. 52).

Managers and foodservice personnel must be diligent in preventing foodborne disease outbreaks in order to maintain a good image among the clients and community they serve. One of management's key functions is to ensure that all staff are adequately trained in safe food handling and preparation (Ollinger-Snyder & Matthews, 1996). All individuals who are involved in food service must possess enough self discipline to apply the correct food handling practices at work. A person who accepts a position in foodservice has an important obligation to handle and prepare food appropriately.

Management must convey the importance of food safety systems like HACCP to employees and make their continued employment dependent upon following correct procedures in handling and monitoring foods and food preparation and service. Every foodservice operation needs a program in place to keep current with new knowledge, especially regarding emerging pathogens, and to ensure that staff employed under their jurisdiction are also kept updated. Re-training and educating foodservice workers is a continuous process. Re-certification with the health department or a course like Servesafe is essential for foodservice workers (Ollinger-Snyder & Matthews, 1996).

Research in Child Care

The people who work in Head Start range from parents of children enrolled to highly trained and educated professionals. Parents of Head Start enrollees make up approximately one-third of the staff. Paraprofessionals or professionals fill the remainder of the positions. Head Start promotes training, and so most staff have training regarding child development and other areas pertinent to children. Volunteers expand the work force of Head Start allowing the staff more freedom to ensure high quality in the program.

Manning (1994) compared the knowledge and attitudes of foodservice workers who worked in either institutional or temporary food service facilities. Manning (1994) found significant differences between the two groups. Her research indicated that foodservice workers from institutions appeared to have better understanding of safe food handling than those employed in temporary foodservice operations .

Management must be totally supportive of serving safe food in order for employees to buy into producing safe food. Training and education of food service workers is a key function of management. In a study by Pond-Smith, Richarz & Gonzalez, (1992) it is stated:

> "The higher percentage of administrators and teachers involved in foodservice indicates that many staff are not trained in food service yet carry out tasks related to food as secondary assignments of their jobs. Non foodservice staff may lack both knowledge and commitment to

> quality food service and this may contribute to problems in nutrition, sanitation and foodservice management p. 484)."

Pond-Smith, et al. (1992) also emphasized that food quality in child care centers can be improved if all foodservice operations were under the direction of qualified, well-trained people.

A variety of training methods should be employed when presenting food safety information since many view the subject as dull. Sample case study investigations where foodservice workers act as the investigators could motivate them to higher standards of practice. Additionally, the involvement of trainees in activities increases their ability to perform adequately. One method that has been successful is using a product called Glo Germ to demonstrate adequate hand washing (Albrecht, et al., 1992, p. 741). Kendrick (1992) reported having good results using "...Glo-Germ, a substance that simulates germs on hands and surfaces" (p. 1109). Workshop participants "see the 'germs' left on their hands, in the webs of their fingers, under their jewelry, and on the backs of their hands and wrists after they wash their hands improperly" (Kendrick, 1992, p. 1109). The Glo-Germ experience was carried out with great success during the regional Head Start nutriition workshop where this research was conducted.

The importance of providing safe food must be emphasized to workers in foodservice, especially the possibilities of loss of life and loss of reputation in the community. Once a food service establishment's reputation is tarnished by an ill-fated foodborne illness outbreak, repairing its status in a community can be very difficult. Waites and Arbuthnott (1990) stated: "Unsafe food has to be withdrawn from sale and destroyed, and adverse publicity can lead to further economic loss, closure, law suits, and prosecution. Loss of confidence in a certain food or producer can be long term" (p. 722). Therefore, if the facility does not have an adequate number of customers, clients, residents, or patients, the worker may lose his or her job.

Food that is safe to consume is usually of high quality because people who are dedicated to preparing safe food tend to prepare food correctly. Therefore, commitment to

produce high sensory quality products coincides with following safe food handling practices.

Foodservice workers must be motivated to practice what they know. This requires self-discipline and continual adherence to excellent food safety practices. Management and employees alike must remind themselves of correct practices and they must see food safety as an important issue affecting their continued employment with the organization. "In general, the difficulties associated with foodborne illness can be overcome provided that our monitoring systems give us an early warning, that our basic science gives us sufficient understanding of the organism or the toxin, and that our control and education system can react quickly enough" (Waites & Arbuthnott, 1990, p. 725).

Experts who have written about Head Start emphasize that well qualified staff are the necessary ingredients for program success. Additionally, it is emphasized that staff in early childhood development programs and day care staff need adequate compensation. The future of our society depends on children and qualified personnel need to be recruited and retained to provide effective services.

The nutrition component of Head Start is important but sometimes it does not receive adequate attention. Food safety is an afterthought, if that, and some days the program operations are hectic and managed in a haphazard manner. Therefore, it is imperative to employ people with food service experience or background and train them appropriately to produce the food for Head Start enrollees. Additionally, Head Start administrators need to take an interest in the nutrition component to ensure safe, attractive food is served to young children.

CHAPTER III

METHODOLOGY

This chapter includes the research design, population and sample, data collection including instrumentation and procedure, and data analysis. Data collection was conducted and completed at a regional Head Start Nutrition workshop.

Research Design

The research design used in this study was a status quo survey in the form of a personally distributed questionnaire. "A status quo survey is used in research to describe, analyze, and interpret conditions that exist (Best, 1981). Surveys are used for establishing associations among variables and providing baseline data (Monsen, 1992). The purpose of this status quo survey was to identify and examine attitudes and knowledge about food safety held by Head Start workshop participants.

The dependent variables of this study were knowledge and attitude scores of Head Start workshop participants. The independent variables were selected personal characteristics of the participants.

Population and Sample

The population in this study included all personnel in Head Start programs in Texas, Oklahoma, New Mexico, Louisiana, Arkansas, and South Dakota whose sponsoring agencies included school districts, private non-profit organizations, and Indian Tribal Organizations. The research sample consisted of all invited participants who attended the Head Start Nutrition workshop at San Antonio, Texas, during the spring of

1995. The questionnaires were distributed to all individuals attending the conference. Guidelines of the Oklahoma State University Institutional Review Board were followed and approval was secured from this group for the study. Participation in this study was voluntary.

Data Collection

Development of Instrument

The research instrument (Appendix A) was adapted from a questionnaire developed and tested by Manning and Snider in 1993. Since the questionnaire had been used previously, the content, validity, clarity, and format were approved by the research committee of the researcher and a panel of foodservice management professionals. Appropriate corrections and additional questions were incorporated into the questionnaire.

The instrument was divided into three sections. Section I included food handling practices and attitudes towards cross contamination, cooling and reheating, personal hygiene, and temperature control. Section II contained questions about food safety knowledge, personal hygiene and temperature control. Section III covered demographic variables of the workshop participants.

Procedure

The questionnaire contained a cover letter (Appendix A) to describe the research and provided instructions for completion of the questionnaire. The reseacher also announced that healthy snacks would be provided to workshop participants for their assistance in the study. Subjects were assured that names would not be associated with individual questionnaires and data collected would be analyzed as a composite result. Questionnaires were distributed in person by the researcher on March 1, 1995, at a Head Start Nutrition workshop in San Antonio, Texas. The participants were asked to complete the questionnaires and give them to the researcher. Correct answers to the surveys were then

provided to study participants as part of the training received at the workshop because they requested the information.

Data Analysis

The questionnaires were coded and tabulated for analysis. The data were then entered and transferred into the computer using the *PC File Software Program* (Buttonware, 1985). Standard statistical procedures were used to analyze data (Statistical Analysis System, 1985). Frequencies and percentages used were computed to describe the demographic variables while t-tests, Analysis of Variance (ANOVA), Duncan Multiple Range Tests and Pearson's r were used to test the hypotheses in this study. Significance level were established at $p \leq 0.05$, unless otherwise specified by the researcher.

CHAPTER IV

RESULTS AND DISCUSSION

This study determined if the attitudes and knowledge toward standard food handling practices of Head Start personnel were associated with the demographic variables gender, age, location, education, training, other work experiences, years in food service, and supervision of foodservice workers. Data were obtained from the questionnaire described in Chapter III. The questionnaire was handed out to 74 Head Start nutrition conference participants and 68 were returned for a total response rate of 92% (n=68).

Demographic Characteristics

Gender, Age, and Location

Females made up the majority of study participants, 85% (n=58) (Table II and Figure 2). Age categories ranged from under 25 to 55 and older. Almost three-fourths (n=47) of the study participants were over 35 with the remainder, age 34 or less (Table II and Figure 3). Participants were from six different states. Texas participants represented about 45% (n=29) of the group, with 35% (n=23) coming from Oklahoma. The remaining subjects were from New Mexico, Louisiana, Arkansas and South Dakota (Table II and Figure 4). The group represented various cultures including Native Americans, Hispanics, Blacks, Asian Americans and Caucasians but an exact breakdown by ethnicity was not obtained.

Education and Type of Training

Training in safe food preparation and serving were most frequently obtained through a course provided by the local health department, formal classes on the job, on the job training by supervisor and through college courses. Except for the local health department course, the types of training were similar to those reported by Manning (Manning, 1994). Training given by coworkers on the job, or courses through area vocational technical schools or via correspondence were pathways where food safety information were obtained (Table II).

TABLE II

NUMBER AND PERCENTAGE OF SUBJECTS ACCORDING TO DEMOGRAPHIC VARIABLES
N=68

DEMOGRAPHIC VARIABLES	Frequency	Percentage
GENDER		
Female	58	85
Male	9	13
Missing	1	1
Total	68	99
AGE		
Below 25	5	7.4
25-35	14	20.5
35-44	22	32.4
45-54	16	23.5
55 and over	9	13.2
Missing	2	2.9
Total	68	99.9
LOCATION		
Texas	29	42.6
Oklahoma	23	33.8
New Mexico	4	5.9
Louisiana	4	5.9
Arkansas	3	4.4
South Dakota	2	2.9
Missing	3	4.4
Total	68	100.0

TABLE II continued

NUMBER AND PERCENTAGE OF SUBJECTS ACCORDING TO DEMOGRAPHIC VARIABLES
N=68

DEMOGRAPHIC VARIABLES	Frequency	Percentage
EDUCATION LEVEL		
Less than High School	1	1.5
High School	15	22.1
College or other	25	36.8
College	19	27.9
MS or Ph.D.	4	5.9
Missing Data	4	5.9
Total	68	100.0
TYPE OF TRAINING *		
Local Health Department course	26	43.3
Formal class-OJT	23	38.3
OJT/Supervisor	22	36.7
College course	21	35.0
OJT/Co-worker	14	23.3
CDM - Level 3	5	8.3
Correspondence	3	5.0
CDM - Level 1	3	5.0
CDM - Level 2	1	1.7
None	1	1.5

*Multiple answers were allowed to be chosen

TABLE II continued

NUMBER AND PERCENTAGE OF SUBJECTS ACCORDING TO DEMOGRAPHIC VARIABLES
N=68

VARIABLE	Frequency	Percentage
YEARS OF EXPERIENCE - HEAD START		
0	10	14.7
1-9	23	33.8
10 or more	8	11.8
Missing Data	27	39.7
Total	68	100.0
EXPERIENCE - OTHER FACILITIES		
Yes	32	47.1
No	22	32.4
Missing Data	14	20.6
Total	68	100.1
YEARS OF EXPERIENCE - OTHER FACILITIES		
0	4	5.9
1-9	16	23.5
10 or more	13	19.1
Missing Data	35	51.5
Total	68	100.0

TABLE II continued

NUMBER AND PERCENTAGE OF SUBJECTS ACCORDING TO DEMOGRAPHIC VARIABLES
N=68

DEMOGRAPHIC VARIABLES	Yes	Percentage
OPERATIONS WHERE EXPERIENCE WERE OBTAINED*		
Commercial Restaurant	16	35.5
Church	14	31.1
Hospital/Nursing Home	12	26.7
School/College	11	24.4
Government Nutrition Program	11	24.4
Other	5	11.4
Fraternal/Service	4	8.9
Military Foodservice	4	8.9
SUPERVISION OF PERSONNEL		
Yes	40	58.8
No	19	27.9
Missing Data	9	13.2
Total	68	99.9

*multiple answers were allowed to be chosen

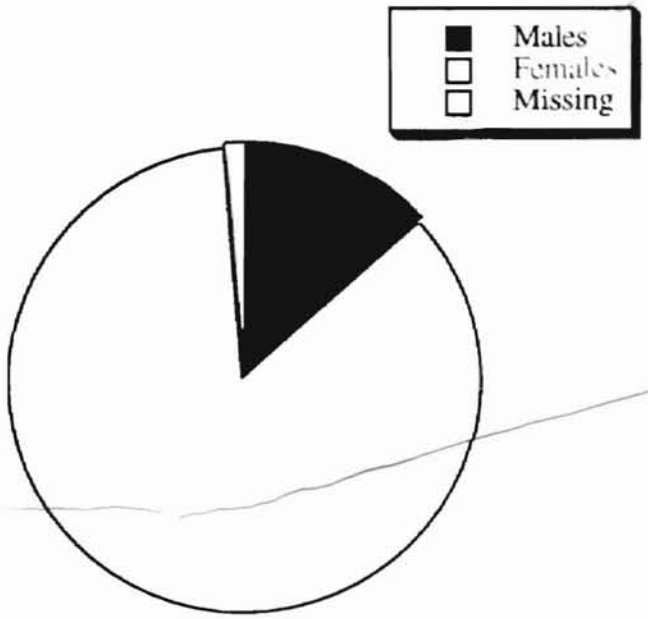

Figure 2: Gender of Participants

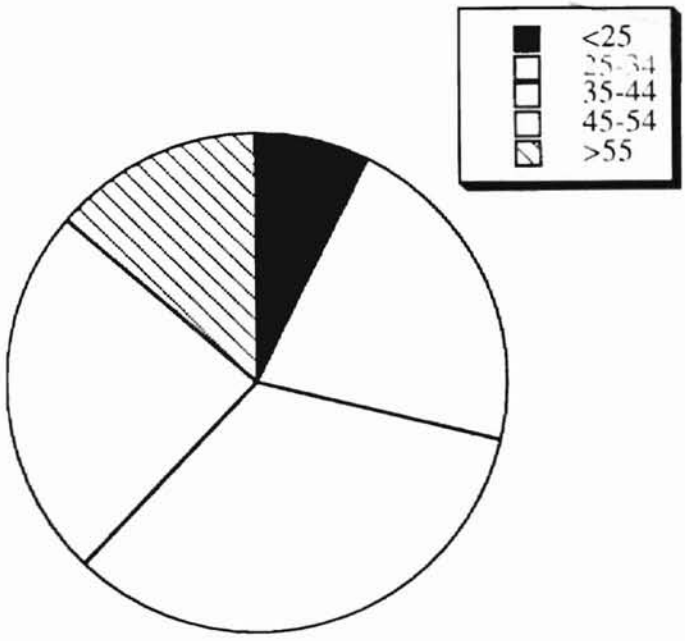

Figure 3: Age of Participants

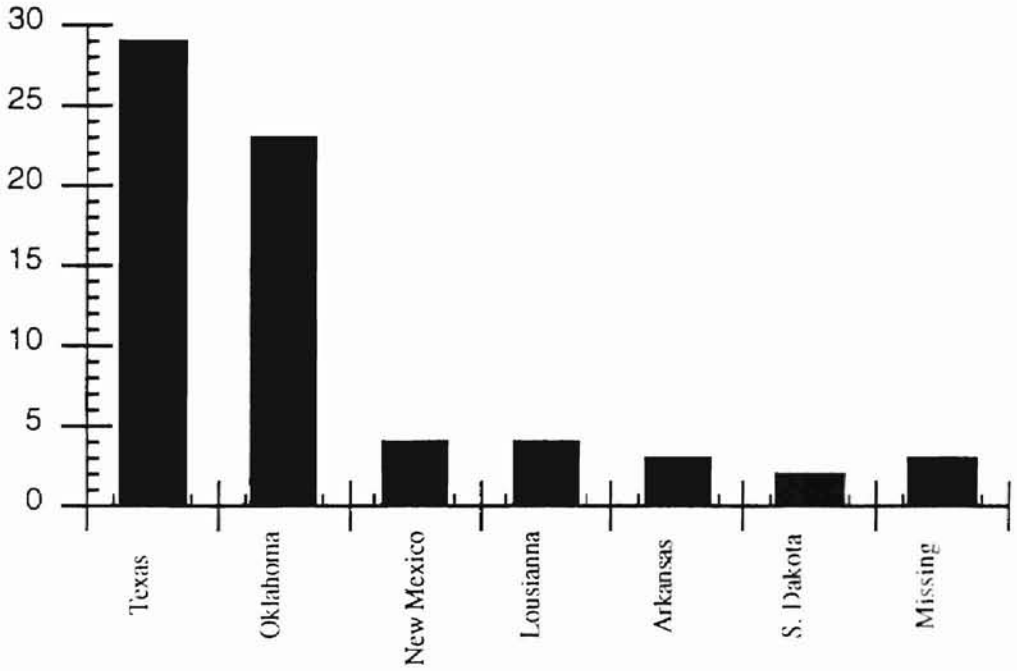

Figure 4: Worksite - Location of Participants

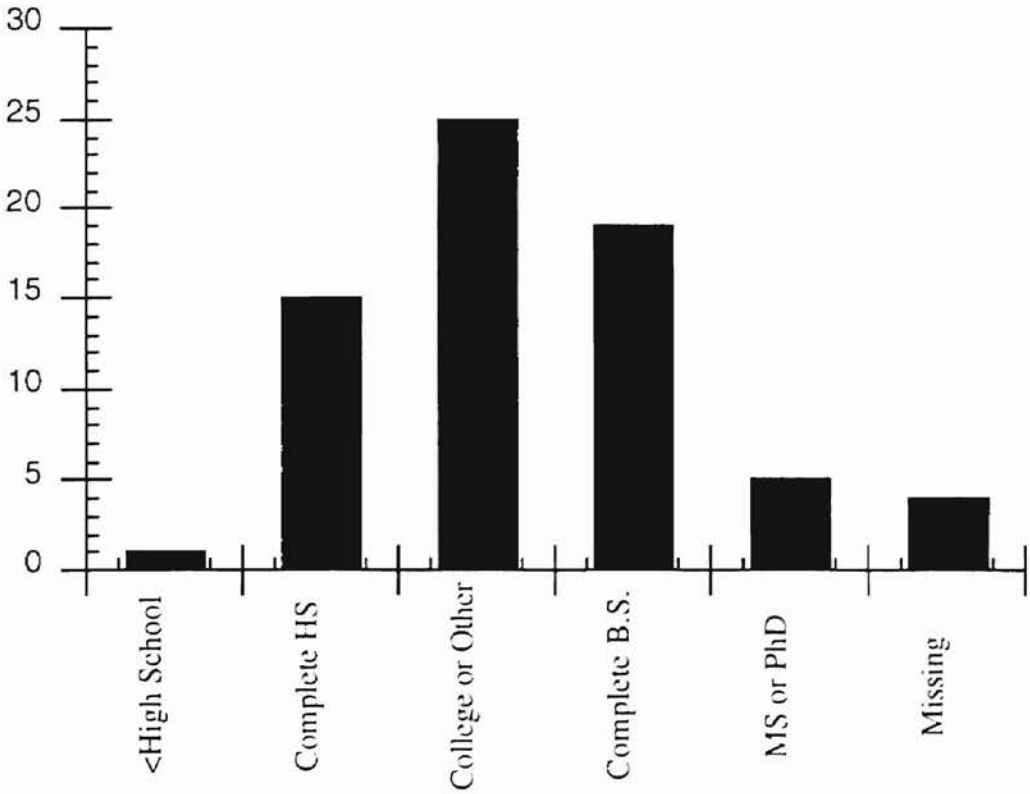

Figure 5: Education Levels of Participants

Foodservice Experience

The participants did not completely answer all questions regarding food preparation and service experiences. Of those who provided answers, one-third indicated that they have 1-9 years of experience in Head Start. Almost half of the participants had experiences in other foodservice facilities such as commercial restaurants, churches, hospitals and nursing homes, schools and colleges and government programs. Close to one-fourth of the subjects have had 1-9 years experience in these facilities (Table II). In Manning's study (1994), institutional foodservice workers obtained work experience in hospitals and nursing homes while temporary workers had their experiences from fraternal or service clubs.

Supervisory Responsibilities

Fifty-nine percent of the Head Start participants stated that their job involved supervising foodservice workers. In contrast, 28% did not supervise foodservice workers (Table II).

Attitudes of Participants Toward Standard Food Safety Practices

Twenty-one statements on attitude toward food safety practices were presented in the questionnaire encompassing personal hygiene, general food handling practices, emerging pathogens and other specific safety issues. The researcher is pleased to report that this group of Head Start personnel were meeting the challenges of food safety on target, especially in their personal hygiene (100%) and in general food preparation techniques (84 - 98.5%) as shown in Table III and Table X in Appendix G. Perhaps these participants possessed the appropriate attitudes toward food safety because they had current foodservice training (Table II).

TABLE III

ATTITUDINAL RESPONSES TOWARD FOOD SAFETY PRACTICES

Statements		% Correct
1.	Clean apron and apparel during food preparation	100.0
2.	Handwashing is important in food safety	100.0
3.	Wash hands after handling raw meat or poultry	100.0
4.	A TB skin test is important for foodservice workers	100.0
5.	Always wear a hair restraint when preparing food at work.	98.5
6.	Do not combine leftover food with fresh food	96.0
7.	Do not eat during food preparation or service except to taste appropriately.	96.0
8.	Food handlers may not smoke in food preparation and service areas.	95.5
9.	When in doubt throw it out	93.0
10.	Use of a thermometer to ensure food is safe to eat	93.0
11.	Sanitizing agents should be used to clean food preparation surfaces	91.0
12.	Okay to thaw frozen food on counter	90.0
13.	Reheat leftovers to 165°F or >	84.0
14.	Container depth is important when refrigerating hot food	78.0
15.	Food at room temperature > 90°F should not be left out more than 1 hour	76.0
16.	Been trained to avoid an *E. coli* outbreak.	46.0
17.	Know what the letters HACCP represent	43.0
18.	Cooling hot foods to room temperature before refrigerating	43.0
19.	Tell by my nose or taste if food item would make a person sick	40.0
20.	Final internal temperature of ground beef is 150°F	31.0
21.	Prepare and serve food in an institutional setting the same as at home.	20.5

See Also Appendix G, Table X

Personal hygiene included wearing clean aprons and apparel during food preparation, frequent handwashing, having a TB skin test, and wearing a hair restraint when preparing food. This study was in agreement with Manning (1994) on wearing clean apparel (Manning, 1994). General food preparation techniques were composed of restraining hair, avoiding cross-contamination, not eating in food preparation areas, and not smoking during food preparation. Also, the majority of subjects responded appropriately regarding use of thermometers to determine food temperatures, sanitizing food preparation surfaces, handling leftover foods, not thawing foods at room temperature, depth of container used for refrigerating hot foods and not leaving food at room temperature over one hour.

The researcher is concerned, however, that these participants were not knowledgeable regarding *E. coli,* HACCP and end point temperature of cooked ground beef. With the *E coli* and *salmonella* outbreaks, personnel involved in food preparation need in-depth training on these subjects.

Knowledge of Participants Regarding Standard Food Safety Handling Practices

Almost all of the participants knew that raw meat, eggs or fish should be kept separate from cooked foods during preparation (N=66, 97%) and that appropriate utensils or supplies should be used in handling cooked foods (N=64, 94%) (Table IV and Table IX, Appendix G). In a similar study by Manning (1994), only about half of her subjects knew about appropriate handling of cooked foods. Sixty-two of the 68 participants (91%) also knew that employees with communicable diseases should not handle food, while 57 (84%) believed that to avoid contamination, a food handler should wash hands often.

Head Start participants, however, have only average knowledge with regards to temperature control and cooling/reheating of foods. Albrecht et al. (1992) reported that 75% of the respondents answered correctly regarding proper cooling and 60% regarding

TABLE IV

KNOWLEDGE OF FOOD SAFETY

Statement	% Correct
1. It is true that raw meat, poultry eggs or fish should be kept separate from cooked foods during preparation.	97
2. When handling cooked foods you should use appropriate utensils or supplies such as plastic disposable gloves, waxed paper, use forks, tongs or long-handled spoons or scoops.	94
3. Employees with communicable diseases should not handle food as long as they are sick.	91
4. A food handler should wash his or her hands after every possibility of contamination.	84
5. Salads containing meat, poultry, eggs, or fish should be prepared with pre-cooled ingredients whenever possible.	72
6. It is true that hot foods should be kept above 140°F and cold foods below	63
7. Frozen foods should be received and stored at 0°F.	60
8. The maximum height of pans used to cool and store food in refrigerators should be not more than 4 inches.	50
9. Dishes should be washed, rinsed and sanitized, and kitchen equipment (such as slicers and grinders) also should be washed, rinsed & sanitized.	7
10. Cooked foods cannot be held at room temperature for more than 3 hours because the bacteria have been killed during cooking.	6

See also Appendix G, Table X

adequate reheating. When asked if pre-cooled ingredients should be used in salads made with potentially hazardous foods, only 72% (n=49) of the subjects answered correctly. Regarding the holding temperatures with the danger zone being between 40°F - 140°F (4.5°C - 60°C), two-thirds of participants answered correctly. The temperature of 45°F (7°C) may have been a complicating factor since different standards have been used over the years, and some temperature standards vary by jurisdiction. The present temperature standard for cold food according to the 1995 Food Code is below 41°F (5°C). Regulatory bodies should further clarify cold temperature standards throughout the foodservice industry. Waites & Arbuthnott (1990) asserted that:

> "The aim of advisory bodies and governments must be to clarify food safety issues and to establish effective guidelines for control of production, processing, distribution, and sale of food. Additionally, clear guidance on hygienic handling and cooking of food in catering establishments and in the home is needed" (p.722).

The correct receiving temperature of frozen foods, 0°F (-18°C), was correctly identified by 60% of the subjects in this study. Half of the subjects correctly answered that the height of pans should not exceed 4 inches, which is proportionally better than Manning's results (1994). Only 21% of institutional foodservice workers and 13% of temporary foodservice workers answered this question correctly in Manning's study (1994).

Serious concerns regarding answers to the following two questions were brought out in this study. A majority of the participants (n=60, 88%), incorrectly answered that kitchen equipment such as slicers and grinders only need to be wiped off with a damp sponge or cloth while dishes should be washed, rinsed and sanitized. Only 6% of the surveyed participants knew the correct answer regarding handling of cooked foods. Many of the subjects 81% (n=55) did not know that cooked food cannot be held at room temperature for more than 3 hours. In contrast, Albrerecht et al. (1992) stated that 90% of the respondents in their study answered correctly on questions about appropriate temperatures for food storage, and reheating or holding foods.

Statistical Analyses

Attitudes Toward Food Safety Practices

$H_0 1$: There will be no significant associations between Head Start participants attitudes toward food safety practices and the selected demographic variables: gender, age, education level, training, years of experience, types of operations, and supervisory responsibilities.

Analysis of Variance (ANOVA) procedure indicated an association between attitudinal practice ratings and education level at p=.0036 (Table V). Subjects with bachelor's or graduate degrees scored significantly better, as expected, on attitudes than those with only some college education or high school diplomas as determined by Duncan's Multiple Range Test (Table VI).

TABLE V

ANALYSIS OF VARIANCE (ANOVA) FOR
ATTITUDINAL PRACTICE RATINGS AND EDUCATIONAL LEVEL

Source	df	Mean Square	F	P
Model	2	169.12	6.31	.0036
Error	50	26.80		
Total	52			

TABLE VI

DUNCAN'S MULTIPLE RANGE TEST FOR
ATTITUDINAL PRACTICE RATINGS AND EDUCATIONAL LEVEL

Education	N	Mean	Group*
High School	11	38.82	A
Some College or Other School	21	37.81	A
College/Graduate	21	33.05	B

*Means with the same letter are not significant at the $p \leq 0.05$ level.

An association was found between attitudes toward food safety practices and on the job training by a supervisor as determined by t-test procedure at $p \leq 0.05$ (Table VII). This seemed reasonable since most employees respect their supervisors and information received from them (supervisors) was put into practice. Attitudes toward food safety practices were also significantly associated with training provided by the local health department as revealed with a t-test procedure at $p = 0.06$. Many jurisdictions require foodservice workers to have a card which is issued on an annual basis for attending and passing a safe food handling class. Since employees are frequently refreshed on this information, it stands to reason that it has a positive effect on their attitude toward safe food handling. This course and a food handling card may be two of the more valuable requirements in foodservice.

Subjects displayed significantly ($p = 0.06$) better attitudinal practices towards food safety if they had prepared food in other places as shown by a t-test procedure (Table VII). Additionally, food safety attitudes were significantly ($p=.0296$) associated with the number of years of experience of participants (Table VII). Those who had less than 10 years experience in preparing food at other places scored significantly better on the attitude score than those with 10 or more years of food preparation in other places. Perhaps those on the job a long time were complacent toward their job and needed periodic retraining.

TABLE VII

T-TEST DETERMINATION ON ATTITUDINAL PRACTICES AND TRAINING AND EXPERIENCE

Group	Yes			No			
	Mean	N	SD	Mean	N	SD	P-Value
OJT By Supervisor	36.78	32	6.64	34.82	17	3.63	.0013
Health Dept. Course	36.44	27	6.77	35.68	22	4.48	.0571
Experience Other Places	35.56	25	4.27	37.74	19	6.45	.0601
Years of Prep/Other Facilities	35.77	47	6.11	36.44	9	2.88	.0296

If you look at the association between food safety attitudes and the education level, training, and level of experience of the participants, the researcher rejected $H_0$1 in part. There were no significant associations between food safety attitudes and gender, age, years of experience, types of operations and supervisory responsibilities; therefore the researcher failed to reject $H_0$1 based on these variables.

The researcher expected to obtain significantly better ratings of attitudes from participants who supervised since they teach the workers and should also demonstrate good attitudes. The lack of association between gender, age, and years of experience, toward food safety was not expected. Results might have been significant if the sample had been larger. Continued research is needed to determine exactly what types of training and experience continue to give positive results relative to safe food handling attitudes.

Food Safety Knowledge

$H_0$2: There will be no significant associations between food safety knowledge of workshop participants and the selected demographic variables as listed in $H_0$1.

A t-test procedure was used to determine the association between the subjects' scores on food safety knowledge and their demographic characteristics. T-test analyses indicated that there was a significant association ($p = 0.0727$) between subjects' gender and knowledge of food safety (Table VIII). Males scored higher on knowledge of safe food handling than females. Males may have been directors, while the females jobs ranged from cooks to supervisors and professionals. The females who attended the nutrition workshop may have assumed they knew the correct answers and did not put out much effort. Additionally, the males in this group may have listened more carefully and worked harder to determine the correct answers.

TABLE VIII

t-TEST DETERMINATION ON FOOD SAFETY KNOWLEDGE AND GENDER

Group	Mean	N	SD	df	P-Value
Males	8.67	9	1.00	8	.0727
Females	7.26	58	1.83	57	

Based on this one association H_O2 is rejected in part. When the remainder of the demographic characteristics were considered, however, the researcher failed to reject H_O2. Although there was no significant association between knowledge and education level, those with higher levels of education scored better than those with high school degrees. The insignificant results may have been due to a small sample and only having 10 questions in the food safety knowledge area.

Knowledge and Attitudes

H_O3: There will be no significant associations between food safety knowledge and food safety attitudinal practices of workshop participants.

The association between knowledge scores and attitude rating is illustrated in a scatterplot (Figure 6). Quadrant four (4) represents the number of subjects who displayed good attitudinal practices along with high knowledge scores. There were 19 subjects in this quadrant. Seventy-five percent (n=41) (quadrant 3 & 4), of the participants had high knowledge scores on food safety while only 34% (n=23) of them showed high attitudinal ratings. The researcher postulated that the higher the knowledge score the better the attitudes toward safe food handling. Even though this is not a strong correlation, the higher score on knowledge had statistically significant association with the attitudinal practices towards food safety. Pearson's correlation coefficient of $r = -0.45$ (Table IX) indicated a weak association, therefore, the researcher rejected H_O3.

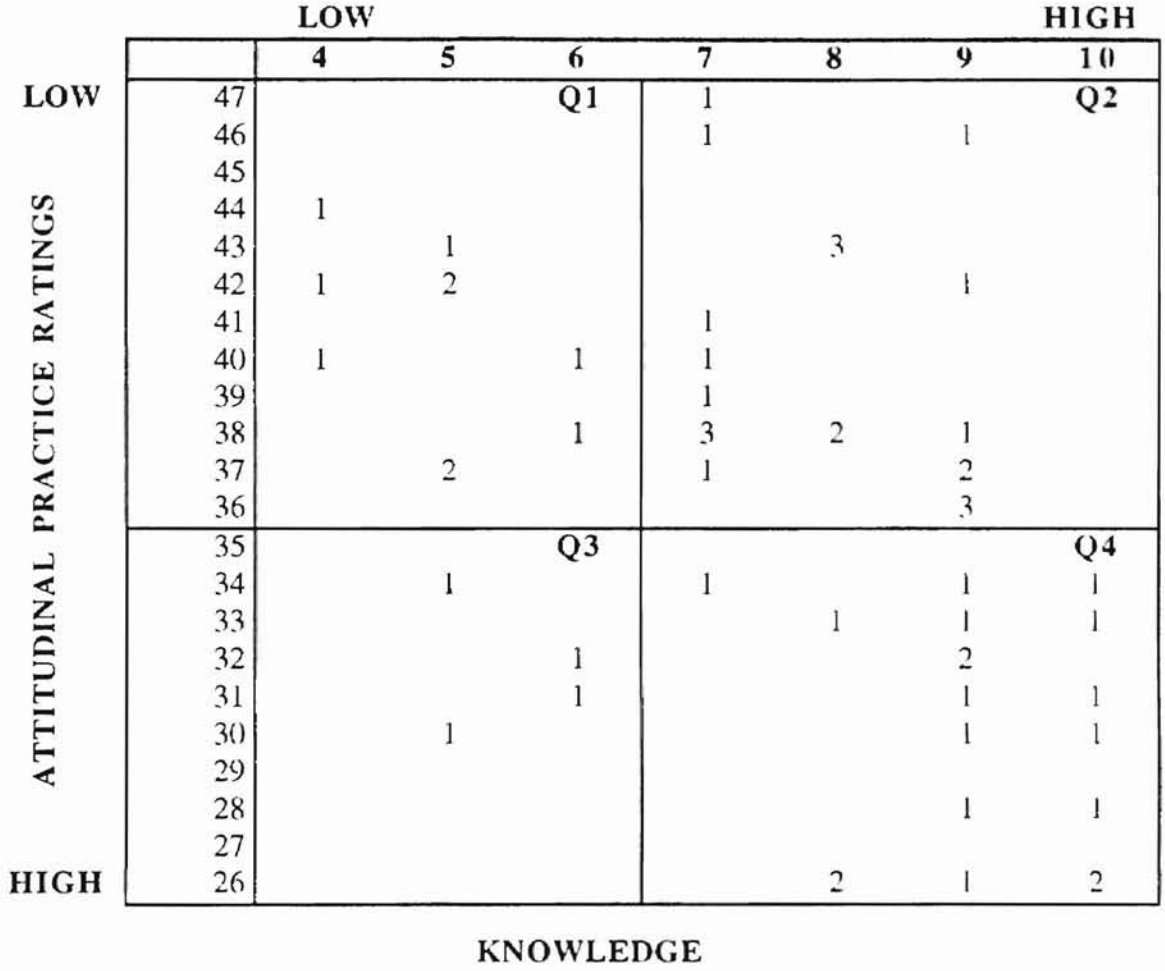

Figure 6: Comparison of Knowledge Score and Attitudinal Practice Ratings

Q=Quadrant	N	%
Q1 = Low Attitudinal Practices & Low Knowledge	10	15
Q2 = Low Attitudinal Practices & High Knowledge	22	32
Q3 = High Attitudinal Practices & Low Knowledge	4	6
Q4 = High Attitudinal Practices & High Knowledge	19	30
Missing Data	13	19
Q3 & Q4 = High Attitudinal Practices Ratings	23	34
Q2 & Q4 = High Knowledge	41	60
Missing Data	13	19

TABLE IX

PEARSON'S CORRELATION COEFFICIENT OF
FOOD SAFETY KNOWLEDGE AND ATTITUDINAL PRACTICES

Variable	N	Mean	Std Dev	Sum
Knowledge	67	7.45	1.80	499.0000
Attitude	56	35.88	5.70	2009

RANGE	MINIMUM Score/Rating	MAXIMUM Score/Rating
Knowledge	4.00	10.00
Attitude	26.00	47.00
KNOWLEDGE	1.0000	-0.4541
	67	55
ATTITUDE	-0.4541	1.0000
	55	56

The researcher expected increased knowledge to be associated with better attitudinal practices. When individuals have more knowledge, they usually have improved work habits. The results of this study emphasized the need to provide further training and follow-up to ensure that what is learned is also applied in the workplace. If a pre-test and post-test had been done, results related to knowledge and training might have been significantly better. More research is needed to determine the variables that do impact food safety attitudinal practices and knowledge.

CHAPTER V

SUMMARY, RECOMMENDATIONS AND IMPLICATIONS

Summary

The challenge of food safety for Head Start personnel was explored in this study. Three hypotheses were postulated to determine if selected variables were related to food safety attitudes and knowledge. A questionnaire was developed by the researcher to obtain data from the participants at a Head Start Nutrition workshop in San Antonio Texas.

The questionnaire was developed in three sections: (1) the first section contained statements about food safety attitudes, (2) the second section included 10 food safety knowledge questions, and (3) the third section was comprised of demographic information. This questionnaire was approved by the Instititutional Review Board at Oklahoma State University. The results of the data collected from the questionnaires completed by the workshop participants are presented in Chapter IV. The sample population were volunteers from six states who attended a workshop on Head Start Nutrition in San Antonio, Texas. Data obtained from 68 questionnaires were analyzed using frequencies, percentages, t-tests, ANOVA, Duncan's Multiple Range Tests and Pearson's Correlation Coefficient.

The majority of the respondents, (n=47) were 35 years of age and older. There were almost six times as many females as males in this study. Among the participants, the majority lived in Texas and Oklahoma and had some college or other education. Courses offered by the local health departments were significantly associated with better attitudes toward food safety practices.

Participants displayed appropriate attitudes regarding wearing clean aprons and clothes, not smoking in food preparation areas, frequent washing of hands and wearing a hair restraint when preparing food at work. Participants were very secure in their attitudes regarding washing hands after handling raw meat or poultry, requiring foodservice employees to have tuberculosis skin test and not eating during food preparation or service except for appropriate tasing of foods before service.

Subjects were unsure if they could identify by smell or taste when a food item would make a person sick, and whether hot food should be cooled to room temperature before being refrigerated. A majority of the subjects incorrectly agreed that food can be prepared the same at work as prepared at home. In the technical support paper for the American Dietetic Association' s position on nutrition standards for child care programs, Briley & Roberts-Gray, (1994) stated: Cooking and serving food for a large group of children is different from preparing foods for one's family. It is important that good institutional food management practices be implemented to protect the health and safety of children (p. 326). Almost 70% were incorrect, not sure, or did not respond to the statement regarding the end temperature of cooked ground beef. About half of the subjects were unable to identify what the letters HACCP represented and a majority had not had training to avoid an *E. coli* outbreak. Subjects incorrectly answered knowledge questions related to holding cooked food for more than three hours at room temperatures, sanitizing kitchen equipment, and the maximum height of pans used to store and cool food in refrigerators.

The relationship between higher scores on knowledge and better ratings on attitudinal practices toward food safety was statistically significant. This would be expected since people should be able to put their knowledge into appropriate practice. Applying information gained from scientific research to everyday practice is a positive strength any foodservice professional should be proud to possess.

Recommendations

The study could have been done statewide and/or nationwide to obtain a larger sample to analyze. The researcher did not get the ethnic breakdown and the subjects' job titles in the demographics and these would be very useful if the study was repeated. Changing the word attitudes to practices could be desirable in future studies

In future studies, a pre-test, post-test design would be very beneficial. Additionally, comparing the test results with actual observations of correct and/or incorrect practices would be very interesting and could provide a different perspective. Conducting a study to investigate the attitudes and knowledge of foodservice workers in Head Start, Child Care and/or School Food and Nutrition Services workers could have been helpful, especially since there is a discernible difference between the amounts and levels of training the groups are required to attain.

Implications

The 1995 Food Code will become an increasingly valuable tool as more foodservice operations implement a Hazard Analysis and Critical Control Points self-inspection system. HACCP is a monitoring program that encompasses all aspects of the foodservice operation from purchasing to consumption of the finished product. It ensures that safe food handling practices are carried out and hazards are identified, eliminated, or significantly reduced. HACCP is the tool that regulatory bodies are depending on to keep foodborne illness outbreaks from increasing significantly. "Since new hazards are emerging from both familiar pathogens such as *salmonella* and previously unrecognized microbial threats, improved surveillance for foodborne infections is essential" (Hennessey et al., 1996, p. 1324)

This study will be useful in providing a tool to assess foodservice workers current level of knowledge and practical food safety attitudes. Results of this research indicated the importance of training foodservice workers in order to prevent foodborne illness

outbreaks. Training has to be continuous. Foodservice handlers must be motivated to practice appropriate procedures and must have the self-discipline to follow-through on what they know regarding safe food handling practices. Everyone who is involved in foodservice needs to be updated on current food safety concerns and procedures. Updated training and re-certification every six months cannot be overemphasized because the turnover rate is usually high in foodservice operations. Waites & Arbuthnott stated "It is the responsibility of managers that all staff are adequately trained in basic food hygiene" (1990, p. 724). Management must be ever vigilant to ensure that correct food safety practices are being adhered to in their foodservice operations.

Head Start is an excellent program serving children at risk, and to maintain its status, high quality comprehensive services must be a priority. Head Start needs to ensure that all programs can deliver on its vision, by striving for excellence in serving both children and families. Excellent service delivery will depend on improved and continuous staff training and career development for Head Start workers. Future follow-up studies should be conducted to determine if Head Start personnel continue to have acceptable knowledge and attitudes toward food safety in carrying out their responsibilities of serving a vulnerable population group--children.

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APPENDIXES

APPENDIX A

COVER LETTER AND QUESTIONAIRE

March 1, 1995

Greetings Healthy Start Workshop Participant!

You have been chosen to participate in a very important study entitled "Food Safety Knowledge of Child Nutrition Food Service Personnel." Since young children are extremely vulnerable to outbreaks of foodborne illness it is very important that the workers who prepare their food have adequate training and correct information regarding the preparation and handling of food. When children receive meals from a child care program the worker involved in the preparation of food is responsible for maintaining the child's well-being by preventing foodborne illnesses. This survey will be used to assess food safety knowledge.

Please take 10 minutes of your time to complete the questionnaire provided Your cooperation and participation are very much appreciated. You do not need to sign your name as all data will be treated confidentially and no individual information or place of employment will be identified. A summary of results will be made available to participants who are registered for the workshop.

Although, participation in this study is voluntary, in appreciation for taking part, there will be a special **treat** for you at the registration desk. To receive your **treat** put the completed questionnaire in the box provided at the registration desk Again, we thank you for your time and participation in this project.

Sincerely,

Mary S. Callison

Mary S Callison
Graduate Student

Lea L Ebro

Lea L. Ebro, Ph.D., R.D.
Major Advisor

Do not sign your name.

Food Safety Questionnaire

I. **HOW DO YOU FEEL ABOUT THESE STATEMENTS?**
Please circle the number which best describes your opinion on a scale of 1 (Strongly Agree) to 5 (Strongly Disagree):

		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
1	When I am at work preparing food, I always wear a clean apron and clean clothes.	1	2	3	4	5
2	Food handlers may smoke in food preparation and service areas.	1	2	3	4	5
3	I believe that frequent and thorough handwashing is very important in keeping food safe to eat.	1	2	3	4	5
4	I always wear a hair restraint (hairnet or cap) when preparing food at work.	1	2	3	4	5
5	I believe that a sanitizing agent should be used to clean the surfaces on which I prepare both raw and cooked food.	1	2	3	4	5
6	It is okay to thaw frozen food on the kitchen counter prior to preparation.	1	2	3	4	5
7	I can tell by my nose or taste when a food item would make a person sick	1	2	3	4	5
8	Hot foods should be cooled to room temperature before being placed in the refrigerator.	1	2	3	4	5
9	I believe that a thermometer is a necessary tool in making sure that food is safe to eat.	1	2	3	4	5
10	In order to prevent foodborne illness, previously cooked foods such as meat or poultry should be thoroughly reheated to 165° F or higher.	1	2	3	4	5
11	When I am in doubt about the safety of a previously cooked food, I throw it out rather than serve it.	1	2	3	4	5
12	After handling raw meat or poultry, I always wash my hands with soap and water.	1	2	3	4	5
13	The depth of the container is important when placing hot food in the refrigerator to be cooled.	1	2	3	4	5
14	When the room temperature is 90° F or above, cooked food should not be left out longer than 1 hour before reheating or refrigerating or freezing.	1	2	3	4	5
15	I prepare and serve the food here at work in the same manner I prepare and serve food at my home.	1	2	3	4	5
16	I think it is important for foodservice workers to have a tuberculosis skin test.	1	2	3	4	5
17	I do not combine leftover food with fresh food.	1	2	3	4	5
18	I know what the letters HACCP represent.	1	2	3	4	5
19	Ground beef should be cooked to a temperature of 150° F	1	2	3	4	5
20	I have had training about avoiding an E coli outbreak	1	2	3	4	5
21	I do not eat food during preparation or service except to taste appropriately	1	2	3	4	5

II. CIRCLE ONE ANSWER FOR EACH OF THESE QUESTIONS:

16. Hot foods should be kept above 140° F and cold foods below 45° F

    TRUE or FALSE or I'M NOT SURE

17. You should keep raw meat, poultry, eggs or fish separate from cooked foods during preparation.

    TRUE or FALSE or I'M NOT SURE

18. You should prepare salads containing meat, poultry, eggs or fish with pre-cooled ingredients whenever possible.

    TRUE or FALSE or I'M NOT SURE

19. Cooked foods can be held at room temperature for more than 3 hours because the bacteria have been killed during cooking.

    TRUE or FALSE or I'M NOT SURE

20. Dishes should be washed, rinsed and sanitized, but kitchen equipment (such as slicers and grinders) only need to be wiped off with a damp sponge or cloth.

    TRUE or FALSE or I'M NOT SURE

21. The maximum height of pans used to cool and store food in refrigerators should be not more than:

    a. 10 inches
    b. 8 inches
    c. 6 inches
    d. 4 inches
    e. I'm not sure

22. Frozen foods should be received and stored at:

    a. 32° F
    b. 20° F
    c. 0° F
    d. I'm not sure

23. Employees with communicable diseases:

    a. may handle food if they wear gloves
    b. should not handle food as long as they are sick
    c. have the right to make their own decision on the matter
    d. I'm not sure

24. How often should a food handler wash his or her hands?

    a. once each hour
    b. before beginning work and after each rest break
    c. after every possibility of contamination
    d. I'm not sure

25. When handling cooked foods, you should:

    a. use plastic disposable gloves
    b. use waxed paper
    c. use forks, tongs or long-handled spoons or scoops
    d. do any of the above
    e. I'm not sure

III. ABOUT YOURSELF: Please check or fill in the appropriate response.

26. Your gender ___ Male ___ Female

27. Your age: ____ younger than 25 ____ 25-34 ____ 35-44 ____ 45-54 ____ 55 & over

28. In what state is your worksite located?

    _____

29 What level of school have you completed?

___ less than high school
___ high school
___ some college or other schooling
___ college
___ Master's degree
___ Doctorate degree

30. What kind of training or education have you had in preparing and serving food safely? (check all that apply)

a. ___ none
b. ___ on-the-job by a co-worker
c. ___ on-the-job by a supervisor
d. ___ formal class on-the-job
e. ___ college course
f ___ correspondence course
g. ___ local health department course
h. ___ Certified Dietary Manager Course - level 1
i. ___ Certified Dietary Manager Course - level 2
j ___ Certified Dietary Manager Course - level 3
k. ___ other (please specify): _____)

30. How many years have you prepared and served food at this facility?

_____ (number of years)

31. Have you ever prepared and served food in places other than this facility?

____ No
____ Yes

32. If you have prepared and served food in places other than this facility, for about how many years? _____

For what kind of food service operation? (check all that apply)

____ commercial restaurant
____ hospital/nursing home
____ fraternal/service club (e.g Lions, Moose, Elks, etc.)
____ school/college
____ government nutrition program
____ military food service
____ church
____ other (please specify) _____

33. Does your job involve supervising foodservice workers?

____ No
____ Yes

THANK YOU!

APPENDIX B

INSTITUTIONAL REVIEW BOARD APPROVAL FORM

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
HUMAN SUBJECTS REVIEW

Date: 07-03-95 **IRB#:** HE-96-001

Proposal Title: FOOD SAFETY KNOWLEDGE AND ATTITUDES OF HEAD START PERSONNEL

Principal Investigator(s): Lea Ebro, Mary S. Callison

Reviewed and Processed as: Exempt

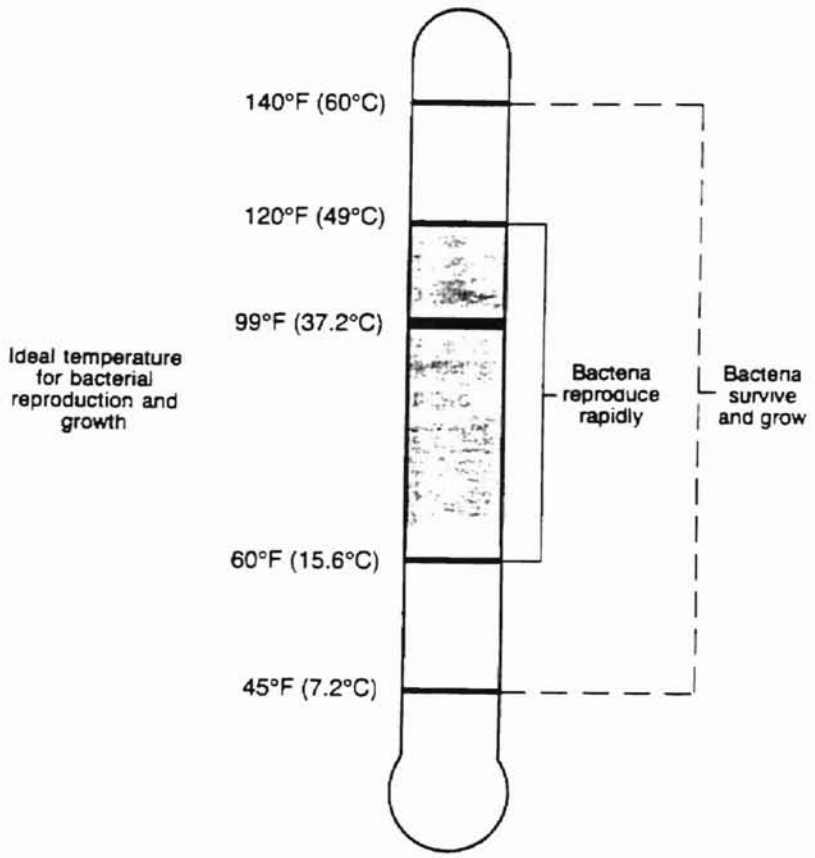
Approval Status Recommended by Reviewer(s): Approved

ALL APPROVALS MAY BE SUBJECT TO REVIEW BY FULL INSTITUTIONAL REVIEW BOARD AT NEXT MEETING.
APPROVAL STATUS PERIOD VALID FOR ONE CALENDAR YEAR AFTER WHICH A CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED FOR BOARD APPROVAL.
ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO BE SUBMITTED FOR APPROVAL.

Comments, Modifications/Conditions for Approval or Reasons for Deferral or Disapproval are as follows:

Signature: _____ Date: July 19, 1995

Chair of Institutional Review Board



Temperature Danger Zone
(Byers et al., 1994 p. 302)

APPENDIX D

MICROBIOLOGICAL HAZARDS

Hazardous Microorganisms and Parasites Grouped on the Basis of Risk Severity[a]

Severe Hazards

Clostridium botulinum types A, B, E, and F
Shigella dysenteriae
Salmonella typhi; *paratyphi* A, B
Hepatitis A and E
Brucella abortis; B. suis
Vibrio cholerae 01
Vibrio vulnificus
Taenia solium
Trichinella spiralis

Moderate Hazards: Potentially Extensive Spread[b]

Listeria monocytogenes
Salmonella spp.
Shigella spp.
Enterovirulent Escherichia coli (EEC)
Streptococcus pyogenes
Rotavirus
Norwalk virus group
Entamoeba histolytica
Diphyllobothrium latum
Ascaris lumbricoides
Cryptosporidium parvum

Moderate Hazards: Limited Spread

Bacillus cereus
Campylobacter jejuni
Clostridium perfringens
Staphyloccoccus aureus
Vibrio cholerae, non-01
Vibrio parahaemolyticus
Yersinia enterocolitica
Giardia lamblia
Taenia saginata

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[a] Adapted from International Commission on Microbiolobical Specifications for Food (ICMSF) (1986)

[b] Although classified as moderate hazards, complications and sequelae may be severe in certain susceptible populations.

Figure 2: Hazardous Microorganisms, 1995 Food Code, p. HACCP 6 & 7

APPENDIX E

PRINCIPLES OF HACCP

PRINCIPLES OF HAZARD ANALYSIS AND CRITICAL CONTROL POINTS

PRINCIPLE # 1
HAZARD ANALYSIS

PRINCIPLE # 2
IDENTIFY THE CRITICAL CONTROL POINTS (CCP) IN FOOD PREPARATION

PRINCIPLE # 3
ESTABLISH CRITICAL LIMITS FOR PREVENTIVE MEASURES

PRINCIPLE # 4
ESTABLISH PROCEDURES TO MONITOR CCPS

PRINCIPLE # 5
ESTABLISH THE CORRECTIVE ACTION TO BE TAKEN WHEN MONITORING SHOWS THAT A CRITICAL LIMIT HAD BEEN EXCEEDED

PRINCIPLE # 6
ESTABLISH EFFECTIVE RECORD KEEPING SYSTEMS THAT DOCUMENT THE HACCP SYSTEM

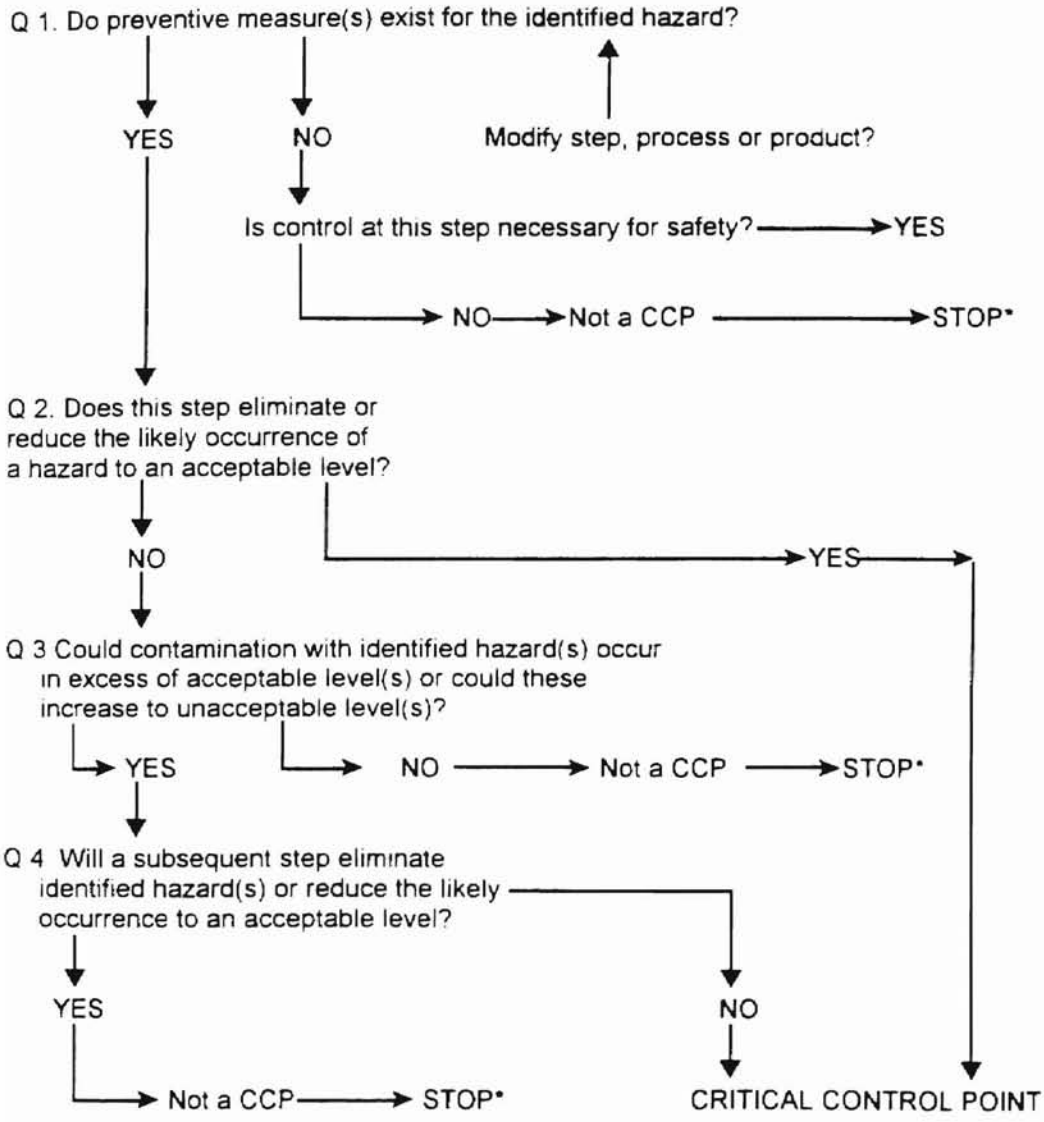
PRINCIPLE # 7
ESTABLISH PROCEDURES TO VERIFY THAT THE HACCP SYSTEM IS WORKING

APPENDIX F

CCP DECISION TREE

Critical Control Point Decision Tree

(Apply at each step in food preparation that has an identified hazard)



*PROCEED TO NEXT STEP IN THE DESCRIBED PROCESS

1995 Food Code p. HACCP 15

APPENDIX G

RAW DATA

TABLE X

Attitudinal Responses Toward Food Safety Practices

Statements	Correct	Incorrect	Not Sure	No Response	Total
1. When I am at work preparing food, I always wear a clean apron and clean clothes. Agree	68 100%	0 0%	0 0%	0 0%	68 100%
2. Food handlers may smoke in food preparation and service areas. Disagree	65 95.5%	1 1.5%	1 1.5%	1 1.5%	68 100%
3. I believe that frequent and thorough handwashing is very important in keeping food safe to eat. Agree	68 100%	0 0%	0 0%	0 0%	68 100%
4 I always wear a hair restraint (hairnet or cap) when preparing food at work. Agree	67 98.5%	1 1.5%	0 0%	0 0%	68 100%
5 I believe that a sanitizing agent should be used to clean the surfaces on which I prepare both raw and cooked food Agree	62 91%	2 3%	1 1.5%	3 4.5%	68 100%

Statements	Correct	Incorrect	Not Sure	No Response	Total
6. It is okay to thaw frozen food on the kitchen counter prior to preparation. Disagree	61	4	2	1	68
	90%	6%	3%	1%	100%
7. I can tell by my nose or taste when a food item would make a person sick. Disagree	27	27	13	1	68
	40%	40%	19	1%	100%
8 Hot foods should be cooled to room temperature before being placed in the refrigerator. Disagree	29	36	1	2	68
	43%	53%	1%	3%	100%
9. I believe that a thermometer is a necessary tool in making sure that food is safe to eat. Agree	63	3	2	0	68
	93%	4%	3%	0%	100%
10 In order to prevent foodborne illness, previously cooked foods such as meat or poultry should be thoroughly reheated to 165 ° F or higher. Agree	57	5	6	0	68
	84%	7%	9%	0%	100%

Statements	Correct	Incorrect	Not Sure	No Response	Total
11. When I am in doubt about the safety of a previously cooked food, I throw it out rather than serve it. Agree	63	4	1	0	68
	93%	6%	1%	0%	100%
12. After handling raw meat or poultry I always wash my hands with soap and water. Agree	68	0	0	0	68
	100%	0%	0%	0%	100%
13. The depth of the container is important when placing hot food in the refrigerator to be cooled. Agree	53	4	10	1	68
	78%	6%	15%	1%	100%
14. When the room temperature is 90 ° F. or above, cooked food should not be left out longer than one (1) hour before reheating or refrigerating or freezing. Agree	52	7	9	0	68
	76%	10%	13%	0%	99%
15. I prepare and serve the food here at work in the same manner I prepare and serve food at my home Disagree	14	50	2	2	68
	20.5%	73.5%	3%	3%	100%
16. I think it is important for foodservice workers to have a tuberculosis skin test Agree	68	0	0	0	68
	100%	0%	0%	0%	100%

Statements	Correct	Incorrect	Not Sure	No Response	Total
17. I do not combine leftover food with fresh food. Agree	65	2	1	0	68
	96%	3%	1%	0	100%
18. I know what the letters HACCP represent. Agree	29	7	29	3	68
	43%	10%	43%	4%	100%
19. Ground beef should be cooked to a temperature of 150 ° F. Disagree	21	25	16	6	68
	31%	37%	23%	9%	100%
20. I have had training about avoiding and *E. coli* outbreak depends	**Agree**	**Disagree**			
	31	16	16	5	68
	46%	23.5%	23.5%	7%	100%
21. I do not eat food during preparation or service except to taste appropriately. Agree	65	2	1	0	68
	96%	3%	1%	0%	100%

TABLE XI

Knowledge of Food Safety Responses

	Correct	Incorrect	Not Sure	No Response	Total
1. Hot foods should be kept above 140 ° F and cold foods below 45° F. True	43	12	9	4	68
	63%	18%	13%	6%	100%
2. You should keep raw meat, poultry eggs or fish separate from cooked foods during preparation. True	66	0	0	2	68
	97%	0	0	3%	100%
3. You should prepare salads containing meat, poultry, eggs, or fish with pre-cooled ingredients whenever possible. True	49	6	7	6	68
	72%	9%	10%	9%	100%
4. Cooked foods can be held at room temperature for more than 3 hours because the bacteria have been killed during cooking	4	55	6	3	68
	6%	81%	9%	4%	100%

	Correct	Incorrect	Not Sure	No Response	Total
5. Dishes should be washed, rinsed and sanitized, but kitchen equipment (such as slicers and grinders) only need to be wiped off with a damp sponge or cloth.	5 7%	60 88%	2 3%	1 1.5%	68 99.5%
6. The maximum height of pans used to cool and store food in refrigerators should be not more than:	34 50%	5 7%	25 37%	4 6%	68 100%
7. Frozen foods should be received and stored at:	41 60%	20 29%	4 6%	3 4%	68 99%
8 Employees with communicable diseases:	62 91%	2 3%	2 3%	2 3%	68 100%
9 How often should a food handler wash his or her hands?	57 84%	9 13%	1 1.5%	1 1.5%	68 100%
10. When handling cooked foods you should:	64 94%	0 0	1 1.5%	3 4%	68 99.5%

VITA

Mary S. Callison, RD, LD

Candidate for the Degree of

Master of Science

Thesis: THE CHALLENGE OF FOOD SAFETY FOR HEAD START PERSONNEL

Major Field: Nutritional Sciences

Biographical:

Personal Data: Born in Manhattan, Kansas, August 26, 1955, daughter of Hugh and Juanita Robinson, raised in Woodward, Oklahoma, married Glenn Callison on January 15, 1975.

Education: Graduated from Woodward High School, Woodward, Oklahoma in May, 1973; attended Northwestern State College in Alva, Oklahoma from 1973 to 1974; received Bachelor of Science degree from Oklahoma State University in Stillwater, Oklahoma in December, 1977; completed Approved Pre-Professional Practice program in December, 1994 from Oklahoma State University; passed registration examination to meet requirements for American Dietetic Association active membership in April, 1995; completed requirements for the Master of Science degree at Oklahoma State University in July, 1996.

Professional Experience: Director of Elderly Nutrition Program, Pawnee Tribe, November, 1980 to June, 1981 and October, 1982 to September, 1985; Project Director, Northwest Oklahoma Senior Citizens Nutrition Council, December, 1985 to July, 1988; Project Director, Wheatheart Nutrition Project, July, 1988 to June, 1994; Consultant Dietitian Head Start, January, 1995 to September, 1995; Food and Nutrition Services Director, Edmond Regional Medical Center, October, 1995 to December, 1995; Consultant Dietitian, long-term care facilities, August, 1995 to present; Clinical Dietitian, St. Joseph's Regional Medical Center, Ponca City, Oklahoma.

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