THE IMPACT OF THE COOPERATIVE EXTENSION SERVICE MASTER CANNER PROGRAM ON FOOD PRESERVATION KNOWLEDGE AND ATTITUDES

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ABSTRACT

THE IMPACT OF THE COOPERATIVE EXTENSION SERVICE MASTER CANNER PROGRAM ON FOOD PRESERVATION KNOWLEDGE AND ATTITUDES

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Food preservation knowledge and attitude change was assessed in 57 people enrolled in nine Michigan Cooperative Extension Service (CES) Master Canner programs. Three Likert scales designed to measure attitudes toward the "nutritional value of home preserved foods", the "use of pressure canning for home preserved foods" and "preserving foods properly and safely" and a 30 item objective food preservation knowledge test were developed. Established methods of knowledge test and attitude scale construction were used with appropriate steps taken to insure validity and reliability of the instruments. Reliability coefficients ranged from .75 to .85 for the knowledge and attitude instruments. Demographic and food preservation background information was collected also. A control group of 84 subjects was solicited from telephone logs of people contacting county Extension offices for food preservation information. The food preservation knowledge and attitude

instruments were administered to Master Canners prior to and upon completion of their training course. Control subjects received the pre- and post-test instruments, through the mail, six weeks apart.

Significant differences in occupations, ages, educational level and place of residence between Master Canners and controls were detected. These groups also differed significantly in their amount of food preservation experience, methods of food preservation previously tried and currently used, types of equipment readily available for use and their sources of food preservation information and training.

Pretesting revealed no significant knowledge or attitude differences between the Master Canners and control subjects. Food preservation knowledge post-test scores were significantly higher for the Master Canners than control subjects. Post-test attitudes toward the "use of pressure canning for home preserved foods" and "preserving foods properly and safely" were significantly more positive in Master Canners than control subjects. Master Canners post-test attitudes toward the "nutritional value of home preserved foods" remained slightly negative following completion of the program and did not differ from those of control subjects. Significant relationships existed between food preservation knowledge, attitudes and certain demographic variables for both groups.

This study demonstrated that participation in the CES

Master Canner program significantly improved food preservation knowledge and promoted positive food preservation attitudes among recipients.

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INTRODUCTION

An increasing number of people are turning to home food preservation to conserve food dollars without jeopardizing the nutritional value of their meals (Kuhn and Andress, 1983). A survey of consumers relative to home canning practices revealed that many are confused about proper home canning methods and their effect on the quality and safety of home canned food (Wolf et al., 1973).

Increasing home canning activity has been paralleled by a nationwide growth in the number of reported botulism outbreaks (Zottola et al., 1978). Several botulism cases linked to improper home canning are reported annually in Michigan, and deaths have occurred. Forty-five cases were reported in 1977 due to improperly home canned food served in a Pontiac, MI, restaurant (Anon., 1977a). Since improperly canned low acid foods can support the growth of Clostridium botulinum, it is extremely important that consumers learn safe canning methods.

The Michigan State University (MSU) Cooperative Extension Service (CES) has responded to consumers' needs for food preservation information through the Master Canner program. The objective of this program is to provide food

preservation training to volunteers so they may assist Extension Home Economists (EHEs) in home food preservation education. The Master Canner program is a six-week series of single lessons on canning acid foods, drying, freezing, canning low acid foods, pickling, and jam and jelly making, taught by trained EHEs. Once the course is completed, each participant is expected to volunteer ten hours to CES programs. Master Canner volunteers may prepare articles for county newspapers and newsletters, answer the consumer food preservation telephone "hotline", present food preservation exhibits at shopping malls or farmers' markets and teach single lesson food preservation classes to clientele.

Problem Statement

Since its development in 1980, the CES Master Canner program has not undergone a formal evaluation. Certification of volunteers was based on program attendance and passage of a written short answer, comprehensive final exam. The latter had been developed and implemented without regard for validity and reliability assessment. No attempt has been made to assess food preservation attitudes of volunteers. Yet, a preliminary survey of EHEs conducted by the investigator prior to the initiation of this research revealed EHEs perceive that many Master Canner volunteers may lack the knowledge necessary to respond to critical food safety issues despite their training. Since

accurate food preservation information may mean the difference between a safe food and a hazardous one, volunteers must be knowledgeable, able to follow current CES food preservation recommendations and able to convey this information to the public. Furthermore, since attitudes may play an influential role in determining how information is accepted and applied, it is important to evaluate whether Master Canners possess favorable attitudes toward the use of proper food preservation procedures and are willing to follow current Extension recommendations.

Objectives

This research study was designed to assess any deficiencies in Master Canners' knowledge or attitudes that may hamper their successful completion of the program's volunteer service component. No valid and reliable measurement instruments currently existed to accomplish this task and provide routine information from which to certify volunteer competence. The development and use of such instruments will provide valuable information from which recommendations for program improvement and volunteer use can be based. Thus, there were three main objectives to this study: (1) to determine if there was an increase in Master Canners' food preservation knowledge over the course of the training program; (2) to determine if Master Canners' attitudes became more positive toward certain food preservation issues over the course of the training

program; and (3) to determine if relationships existed between Master Canners' food preservation knowledge and attitudes prior to and upon completion of the training program.

To accomplish these objectives this research will focus on the development and implementation of an appropriate research design which controls for variables that may subsequently threaten the study's internal and external validity. Instrumentation development will be subject to rigid controls for validity and reliability assessment to insure accurate, appropriate and comprehensive treatment of subject matter material.

REVIEW OF LITERATURE

This research focuses on assessing the food preservation knowledge and attitudes of participants enrolled in the CES Master Canner program. Since appropriate measurement instruments are ultimately of paramount importance to the study's outcome and interpretation of results, this chapter will focus on measurement and design issues relevant to this research. The concept of attitude and its measurement will be discussed. Issues relative to the measurement of nutrition knowledge will be presented. A review of published literature, pertaining to assessment of nutrition knowledge and attitudes, will be addressed.

Attitudes

While the concept of attitude has played a central role in the development of American social psychology, there is no single definition of attitude acceptable to all researchers. In 1935, Allport reviewed the general area of attitude theory and research. After considering the numerous definitions of attitude found in the literature, he concluded that most investigators viewed an attitude as

"a learned predisposition to respond to an object or class of objects in a consistently favorable or unfavorable way". He further emphasized that this bipolarity in the direction of an attitude (the favorable versus unfavorable) was often regarded as its most distinctive feature. In a similar manner, Thurstone (1932) defined an attitude as "the affect for or against a psychological object". Thus attitude was conceptualized as a simple unidimensional concept. Several investigators have since adopted this viewpoint (Edwards, 1957; Shaw and Wright, 1967).

Chein (1948) later argued for a multidimensional view of attitudes. His conceptualization suggested that a person's attitude toward an object consisted of three components: (1) a cognitive component representing a person's information about an object; (2) an affective or emotional component which deals with a person's overall feelings of like or dislike for the object; and (3) a conative or behavioral component which refers to the person's tendency to act toward the attitude object in a reasonably consistent way. Others have endorsed this multidimensional approach to the study of attitudes (Krech et al., 1962; Zimbardo et al., 1977).

Despite the discrepancies involved in forming a universal definition of attitude, the operations by which attitudes are commonly measured almost invariably yield a single score that is reflective of the unidimensional view. Standard attitude scales (e.g., Likert, 1932;

Thurstone, 1932 scales) arrive at a single number designed to index this general evaluation or feeling of favorableness toward the object in question. Thus, although attitudes are regarded by some to include affective, cognitive and conative components, it is usually only evaluation of the affective component that is measured and treated by researchers as the "essence" of attitude.

Concepts such as beliefs and intentions are often used synonymously with the concept of attitude in the literature. Fishbein and Ajzen (1972) argue for a differentiation among these terms. They make the following distinctions: attitude refers to a person's favorable or unfavorable evaluation of an object; beliefs involve the individual's perception of the likelihood of the existence of the concept or of a relation between two concepts (i.e., the probability that a particular concept exists); and, behavior intentions link the subject's willingness to engage in various behaviors with respect to a given person or object. Beliefs and behavioral intentions are seen by Fishbein and Ajzen (1975) as determinants of an individual's attitude.

Attitude Measurement

Many types of measurement procedures have been used to study attitudes. In a review of research published between 1968 and 1970, Fishbein and Ajzen (1972) found more than 500 different instruments designed for this purpose. These

included standard attitude scales (e.g., Likert, Thurstone, Guttman, semantic differential); indicies across various verbal items; single statements of feelings, opinions, knowledge or intentions; observations of overt behaviors; and physiological measures.

Standard attitude scales, such as the Likert scale (Likert, 1932), ask subjects to indicate their agreement or disagreement with a set of attitude statements about the attitude object. The final instrument consists of a relatively small number of attitude statements which resulted from analyzing responses to a larger pool of initial items.

Likert scales have been used extensively in the area of nutrition education research (Biltz and Derelian, 1978; Lohr and Carruth, 1979; Maiman et al., 1979; Axelson and Penfield, 1983; Boren et al., 1983). Their popularity is due to their relative ease of construction, the simplicity of response and the fact that otherwise unmotivated subjects can respond in little time.

Oppenheim (1966) describes several principles of measurement which should be followed in the construction and evaluation of an attitude instrument. These include: (1) unidimensionality, (2) linearity, (3) reliability, and (4) validity.

Unidimensionality: An attitude scale is unidimensional if it measures a single attitude. A person's attitude score, therefore, reflects only his/her position on the

underlying attitude continuum and two or more persons who have the same attitude score will be at the same position on the continuum. If the attitude scale is not unidimensional, it means that more than one attitude is being measured. Factor analysis is often used to determine items in an attitude instrument that are highly correlated. Items meeting this criterion are assumed to be homogeneous and refer to only one underlying construct.

Linearity: Unidimensional also assumes the attitude scales are linear, placing individuals along a single dimension of affect. In other words, the criterion of linearity perceives the nature of attitudes as straight lines, running from positive, through neutral, to negative feelings about the object or issue in question.

Reliability: Instrument reliability refers to the extent to which an attitude scale yields the same results in repeated trials. Measurement of any phenomenon always contains a certain amount of random error. As Stanley (1971) has observed, "the amount of random error may be large or small, but it is universally present to some extent." Because repeated measurements never exactly equal one another, unreliability is always present to at least a limited extent. While repeated measurements of the same phenomenom never precisely duplicate each other, they do tend to be consistent from measurement to measurement. This consistency in repeated measurements of the same phenomenon is referred to as reliability. The more

consistent the results given by repeated measurements, the higher the reliability of the measuring procedure; conversely, the less consistent the results, the lower the reliability (Carmines and Zeller, 1979).

Four basic methods exist for estimating the reliability of empirical measurements. With the test - retest method, the same test is given to the same people after a period of time. One then obtains the correlation between scores on the two administrations of the same test as the reliability estimate. The alternate form method is similar to the test-retest method in that it also requires two testing situations with the same people. On the second testing, however, an alternate form of the same test is administered. The correlation between the alternative forms provides the estimate of reliability. In contrast, the split-halves method can be conducted when the test is given on only one occasion. Specifically, the total set of items is divided into halves, and the scores on the halves are correlated to obtain an estimate of reliability. Internal consistency reliability is determined by computing an interitem correlation matrix from which coefficient alpha or Cronbach's alpha (Cronbach, 1951) can be calculated for the entire scale.

Validity: While reliability focuses on the extent to which indicators (i.e., attitude scale items) provide consistent results across repeated measurements, validity concerns the crucial relationship between concept and

indicator. An attitude instrument is valid if it measures what it is designed to measure rather than reflecting some other phenomenon.

To be valid, an instrument must match the depth and scope of its intended topic, must be reasonable and understandable to its intended audience, and must bear a measureable relationship to the characteristic or quality that it is intended to assess (Talmage and Rasher, 1981).

Content validity considers the representativeness and appropriateness of items in an instrument. Ideally, an instrument should be representative of a specific domain of content defined by the researcher. There is no agreed upon criterion for determining the extent to which a measure has attained content validity. In practice, the expertise of content area specialists is often used to determine the relationship of items to the entire content domain.

Face validity relates to the superficial appearance and reasonableness of the test from the test taker's perspective. Test items, language used, format and procedures are subject to review. Persons who have expertise with the intended audience, or audience representatives are good judges of face validity (Talmage and Rasher, 1981).

Construct validity requires that the instrument be based upon a sound theory or conceptual rationale. Used in this context a construct refers to a hypothetical variable, a name given to a group of attitude items thought to be

interrelated. If the items are highly correlated, it is assumed that the attitude scale is unidimensional and its component items measure the same underlying attitude construct. Factor analysis is a technique for construct validation. Its usefulness lies in determining the unidimensionality of attitude scales or showing that specific items refer to a single construct.

Several references exist outlining suggested procedures for constructing and analyzing attitude scales (Edwards, 1957; Shaw and Wright, 1967). Yet, a review of pertinent literature summarized in Table 1 shows that many researchers, publishing since 1972, provide little or no evidence of appropriate item construction, validity or reliability. Six of the eight studies were reported in the Journal of the American Dietetic Association.

Ehlers and Fox (1982) assessed the attitudes of food cooperative shoppers using an 18 item Likert scale. Response categories were "agree", "disagree", or "undecided". No criteria were specified for establishment of content or construct validity. No instrument pretest procedures and no reliability coefficient were reported.

Werblow et al. (1978) developed 19 attitude statements related to general nutrition and nutrition for the athlete. Several statements had been validated and used in previous work but an undiscernible number were developed for this study. Some degree of content validity can be assumed since statements were written based on a review of

Table 1. Summary of selected instrumentation used in published nutrition attitude research studies.

Reference	Subjects/Study Focus	Instrument	Validity	Reliability	Instrument Pretested
Petersen and Kies (1972) JNE (a)	910 K - 3rd grade teachers attitudes toward teaching nutrition and school feeding programs	5 point Likert scale - number of items not reported	Content - expert review Construct - not reported	Not reported	No
Schwartz (1975) JADA (b)	313 high school graduates attitudes toward the importance of nutrition	30 items on an agree - disagree scale	Scale validated in previous research (c)	Not reported	No
Schwartz (1976) JNE	352 public health nurses attitudes toward the importance of nutrition	14 items on an agree - disagree scale	Scale validated in previous research (d)	Not reported	No
Krause and Fox (1977) JADA	292 physicians attitudes toward nutrition, the profession of dietetics, role of the physician in nutrition education, nutrition education in medical school	20 items on a 3 point Likert scale	Content - not reported Construct - not reported	Not reported	No
Milton and Fox (1978) JADA	170 physicians attitudes toward infant feeding practices	18 items on a 5 point Likert scale	Content - not reported Construct - not reported	Not reported	No
Werblow et al. (1978) JADA	94 female collegiate athletes attitudes toward general nutrition and nutrition for the athlete	19 items on a 5 point Likert scale	Content - expert review Construct - not reported	Not reported	Yes - unspecified number of participants

Table 1. (cont'd)

Reference	Subjects/Study Focus	Instrument	Validity	Reliability	Instrument Pretested
Ehlers and Fox (1982) JADA	175 food cooperative shoppers attitudes toward natural foods and the chemicals used in processing or growing foods	18 items on a 3 point Likert scale	Content - not reported Construct - not reported	Not reported	No
Ross (1984) JADA	71 nursing students attitudes toward the role of the nurse in nutrition education, the role of the hospital dietitian, nutrition education in nursing, general nutrition	15 items on a 5 point Likert scale	Scale validated in previous research (e)	Not reported	No

(a) - Journal of Nutrition Education
(b) - Journal of the American Dietetic Association
(c) - Adapted from Eppright et al., 1970
(d) - Adapted from Schwartz, 1975
(e) - Adapted from Schwartz, 1975, 1976; Vickstrom and Fox, 1976; Lohr and Carruth, 1979

literature. Instrument reliability was not reported.

An 18 item, five point Likert scale was developed to measure attitudes of Nebraska physicians toward infant feeding (Milton and Fox, 1978). No information was provided by the authors on content or construct validity, pretesting or reliability.

Several additional nutrition attitude research studies (Table 1) used instruments without published reliability coefficients (Petersen and Kies, 1972; Schwartz, 1975; 1976; Krause and Fox, 1977; Ross, 1984).

The importance of instrument validation and reliability assessment is paramount. Determination of content validity, unidimensionality of attitude scales and instrument stability over time is important, especially if expressed attitudes are considered as predictors of nutrition knowledge or subsequent behavior. The interpretation of current published nutrition attitude reports (Table 1), failing to ascribe to such rigorous methodology, is questionable.

An attitude scale may be evaluated using conceptual and/or empirical approaches. With the conceptual method, attitude statements are determined subjectively and appropriate statements are then assigned to the particular scale describing that attitude. The empirical method utilizes subjects responses to the statements as the basis for forming a scale. Conceptual and empirical approaches to Likert attitude scale construction were compared by Lohr

and Carruth (1979). In this study, statements to assess nursing students' attitudes toward nutrition were derived from the literature or were written by the researchers. Items were evaluated against Edward's (1957) informal criteria for attitude item construction. A five point response format, from "strongly agree" to "strongly disagree", was used. The authors discussed use of coefficient alpha versus split-half reliability coefficients and the item to total correlations as a basis for item selection. Based on their results the empirical method of scale development and coefficient alpha reliability estimates appear to be the most promising for assessing nutrition attitudes. They also stressed the need for improving the attitude research methodology used by nutrition education researchers.

Likert Scale Construction

The Likert approach to attitude assessment is a widely employed method that allows the respondent to differentiate among several levels of feelings about an issue. Likert's (1932) scaling technique requires a large number of monotone items, i.e., items having the characteristic that the more favorable the individual's attitude toward the attitude object, the higher the expected score for the item. The investigator determines on an a priori basis whether an approval or disapproval response indicates a positive or negative attitude. The items are then given to

a sample of the target population and subjects are asked to respond, usually along a five point scale of strongly agree, agree, undecided, disagree and strongly disagree. The scores for each person are summed by assigning values of 5, 4, 3, 2 and 1, respectively, to the categories. Scoring is reversed for negatively worded items. Items are eliminated if they do not empirically tap the same attitude as the other items in the scale. Likert originally proposed a criterion based on a simple critical ratio. On the basis of the total score, the top 10 percent and lowest 10 percent of subjects were selected. The mean on each item was then determined for subjects fitting these categories. An item was accepted or rejected depending on its ability to discriminate the top 10 percent from the lowest 10 percent. The advent of computer technology, however, has allowed the use of indicies such as correlations among items or the correlation between a single item and the score for the total scale to help make judgments for final item selection.

Reliability of properly designed and tested Likert scales tends to be good, with reliability coefficients of .75 or better (Shaw and Wright, 1967). No attempt is made to insure equality of units, but by using factor analysis for final item selection, a scale approaches unidimensionality. Likert scales have been criticized for producing only ordinal level scores, yet many researchers inappropriately use statistical significance tests

associated with higher levels of measurement. Overall, Likert scales tend to perform well when it comes to a reliable, rough ordering of people with regard to a particular attitude. Apart from their relative ease of construction, Likert scales have the advantage of providing precise information about the respondent's degree of agreement or disagreement.

Nutrition Attitude Research

Attitudes may be important in the translation of nutrition knowledge into actual food behavior yet their exact role remains unclear. Numerous studies have been reported which attempt to measure nutrition attitudes of individuals. While the research designs and significance tests used in these studies were not always appropriate, the information is presented as an introduction to nutrition attitude research. For example, several studies have attempted to determine what influences the food attitudes of children. Breckenridge (1959) stated that "an understanding of children's food preferences and prejudices and of their dynamics can be of value both to those who plan and supervise the feeding of children and to those who are engaged in promoting sound food habits through nutrition education." Caliendo et al. (1977) found that the more positive a mother's attitude toward meal planning, her role as a homemaker and the importance of good nutrition for her child, the more likely her child

demonstrated good dietary quality in his/her meals. The more unfavorable a mother's attitude toward her role as mother and homemaker, the lower her child's score for dietary quality. Kerrey et al. (1968) suggested that food practices and attitudes established during the early years may affect food choices, and consequently, nutritional status throughout life. This was supported by Beyer and Morris (1974) who found that food attitudes and practices of children studied during their preschool years and again during their early elementary grades were fairly constant.

Perkins et al. (1980) used a 53 item Likert scale to assess attitudes of elementary teachers about the school lunch program. In general, the teachers held positive attitudes about the program but strongly disagreed that their presence in the lunchroom would influence students' eating habits. A significant relationship was noted between teachers' perceived view of the quality of food served and student participation. The authors suggested that when elementary teachers believed the quality of food served was good, this attitude was conveyed in their own behavior and thus influenced student participation in the program.

Assessment of teachers' attitudes toward nutrition is critical both in planning and evaluating nutrition education programs for schools. Cook et al. (1977) found that the attitude of K-6 teachers toward nutrition education was significantly related to the time they

devoted to teaching nutrition; those with favorable attitudes spent more time teaching. In contrast, O'Connell et al. (1981) found K-6 teachers favored nutrition education for school children, but this positive attitude was not accompanied by a personal willingness or interest in teaching nutrition. These investigators also showed seventh through twelfth grade teachers of home economics, health-physical education and life sciences had higher attitude scores on an "interest in teaching nutrition" scale than teachers in non-nutrition related subject matter areas. However, all teachers preferred to have nutrition integrated into an existing course rather than offer it as a new class.

Since a nurse's contact with a patient provides formal and informal opportunities for nutrition education, nursing students' attitudes toward nutrition were studied (Lohr and Carruth, 1979). In general, the nursing students surveyed felt that nutrition is an important aspect of patient care and had positive attitudes toward nutrition education. The majority agreed that nutrition should be required and disagreed with the statement that nutrition should be phased out of the curriculum. In contrast, Vickstrom and Fox (1976) reported that the least favorable attitudes expressed by practicing registered nurses were found on a subscale entitled "nutrition in nursing school."

Attitudinal data and actual weight gain were obtained from 29 women to determine whether attitudes toward

slimness affected weight gain during pregnancy (Palmer et al., 1985). Forty-one percent of the respondents had a negative attitude toward weight gain during pregnancy. Attitude scores correlated significantly with actual weight gain. A prenatal nutrition attitude and practices survey of 150 mothers of newborns found many of the women agreed with the statement that "weight gain during pregnancy should be kept down to under twenty pounds to make delivery easier" (Schwartz and Barr, 1977).

Two studies focused on measurement of attitude change based on respondents participation in a discussion or course. Bruhn et al. (1986) conducted a survey of consumer attitudes toward food irradiation. Attitude change was measured using a pretest and post-test questionnaire with an intervening discussion session on food irradiation uses and safety. Post-test scores indicated a higher level of concern for food preservatives and chemical sprays and an increased willingness, from a safety perspective, to buy irradiated products. These results suggest that consumers' attitudes toward food irradiation can be positively influenced by an educational effort. Biltz and Derelian (1978) developed a Likert format attitude questionnaire to measure attitudes of clinical dietitians toward: (1) client counseling, (2) educational methods, and (3) clients. The questionnaire was administered to the dietitians prior to and upon completion of an eight week course devoted to planning and using successful nutritional

care plans in client counseling and education. Following the course, dietitians expressed more positive attitudes toward clients and client counseling due to the acquistion of new skills.

Measurement of Nutrition Knowledge

Evaluation is an integral part of the educational process. Educators have long tested for achievement in the classroom and the process is well defined (Ebel, 1979). Tests have also been used, in part, to certify the competence of lawyers, doctors, accountants, nurses, dietitians and other professionals.

The need to develop high quality evaluation instruments to document the effectiveness of nutrition education programs is obvious. Yet, evaluation methods used by nutrition educators vary from personal judgements of material learned to pencil and paper objective tests of nutrition knowledge. Many authors fail to report methods used to prepare and pretest instruments and provide no evidence of test reliability or validity. This lack of standard methods and instruments to test nutrition knowledge makes it difficult to compare results and to draw conclusions about any particular group.

Several excellent resources exist outlining procedural steps for planning, developing and administering an objective test for any subject matter (Thorndike, 1971; Ebel, 1979; Gronlund, 1982). Generally, test development

includes the following steps: (1) determining the test purpose, (2) identifying and defining the intended learning outcomes, (3) preparing the test specifications, (4) writing the test items, (5) compiling the preliminary test forms, (6) pretesting the items, (7) analyzing the item statistics, (8) compiling the final test forms, and (9) administering the final test (Tinkleman, 1971; Gronlund, 1982). An underlying premise to proper test development is that the final instrument will also be valid and reliable. Appropriate measures to insure validity and reliability are fundamental to the test development process.

In addition, the analysis of subjects' responses to test items is a powerful tool for test improvement. Item analysis indicates which items may be too easy or too difficult and which may fail for other reasons to discriminate clearly between the better and poorer examinees. A test composed of items revised and selected on the basis of item analysis data is almost certain to be more reliable than one composed of an equal number of untested items (Ebel, 1979).

Despite the availability of references that outline procedures for constructing an objective test, many researchers fail to adhere to suggested guidelines. Several examples are given in Table 2 which demonstrate inconsistencies in methods used to assess nutrition knowledge in the literature.

Table 2. Summary of selected instrumentation used in published nutrition knowledge research studies.

Reference	Subjects/Study Focus	Measurement Instrument	Instrument Validity	Instrument Reliability	Results
Emmons and Hayes (1973)	Nutrition knowledge of 486 mothers	Telephone interview using 2 questions related to types of foods needed in childrens' diets	Not reported	Not reported	Mothers had difficulty providing valid nutritional reasons for including certain foods in their child's diet
Cho and Fryer (1974)	Nutrition knowledge of 138 collegiate physical education (PE) majors and 81 non-nutrition majors enrolled in a nutrition course (NC)	50 true - false items relating to general nutrition, food composition and misconceptions about foods	Not reported	Not reported	PE students averaged 40% correct test responses, NC students averaged 74% correct
Krause and Fox (1977)	Nutrition knowledge of 292 physicians	55 true - false questions on basic and therapeutic nutrition	Content - expert review	Not reported	68% of basic nutrition questions answered correctly; 62% of therapeutic nutrition questions answered correctly by physicians
Yetley and Roderuck (1980)	Nutrition knowledge of 116 young spouses	11 item multiple choice test - content not specified	Content - expert review	.64 (husbands) .60 (wives) Cronbach's alpha	Mean test score for husbands = 5.4 mean test score for wives = 5.9
Woolcott et al. (1981)	Nutrition knowledge of 195 executive men	20 multiple choice items relating to general nutrition and nutrition and heart disease	Content - expert review	0.61 Cronbach's alpha	Mean test score was 11.8 with scores ranging from 5 to 18 points
Graves et al. (1982)	Nutrition knowledge of 106 vegetarians and 106 non vegetarians	80 multiple choice items on basic nutrition and vegetarianism	Content based on introductory nutrition course material	0.95 Kuder - Richardson 20	Vegetarians scored significantly higher on tests of basic and vegetarian nutrition

Table 2. (cont'd)

Reference	Subjects/Study Focus	Measurement Instrument	Instrument Validity	Instrument Reliability	Results
Bedgood and Tuck (1983)	Nutrition knowledge of 92 athletic coaches	Mail survey 43 item questionnaire on general and sports nutrition	Content-expert review	0.65 test - retest method	Test scores ranged from 28 - 84% correct; 14 respondents scored 70% or better
Spitze (1983)	Nutrition knowledge of 100 university employed men	280 true - false items related to nutrients, metabolism, nutrient sources	Content - expert review	.95 Kuder - Richardson 21	Mean test score was 181 correct (65%) scores ranged from 37 to 239 correct
Ross (1984)	Pre and post nutrition knowledge of 71 nursing students with intervening nursing nutrition course	100 multiple choice items on clinical nutrition, nutrients, lifecycle nutrition and nutritional assessment	Not reported	Not reported	Post-test scores (mean = 80.6) were significantly greater than pretest scores (mean = 48.4) following completion of the nutrition course

Emmons and Hayes (1973) used a telephone interview to determine nutrition knowledge of mothers. Two questions were asked: What foods or types of food do you try to include in your child's diet each day? and Why do you feel each of these foods should be included? While the authors concluded that mothers had little nutrition knowledge based on their answers, the number and content of questions asked seem grossly insufficient to adequately assess anyone's nutrition knowledge.

Spitze (1983) used a 280 item true/false test to determine the nutrition knowledge of male employees at a large midwestern university. She pilot-tested it with students, teachers and dietitians and the test underwent seven revisions. No criteria were given for item revisions. A reliability coefficient of .95 was reported for the final test version. Content validity of the test must be assumed, since the author consulted nutrition specialists during test development.

Bedgood and Tuck (1983) measured the nutrition knowledge of Texas high school athletic coaches using a 43 item questionnaire. A panel of subject matter experts validated the questionnarire and it was tested for reliability (test-retest method) using college physical education majors. The number of students participating in the pretest was not reported and item analysis procedures were not specified. The reliability coefficient for the 43 statement knowledge test was reported as .65.

Yetley and Roderuck (1980) initially developed a 66 item knowledge test for young spouses. After test evaluation by faculty members and pretesting on 105 junior college and university students, plus subsequent item analysis, only 11 items remained. The authors reported reliability coefficients of .64 and .61, for husbands and wives, respectively, following test administration.

Eppright et al. (1970) developed a knowledge test for mothers consisting of 35 items to be answered as "true", "false" or "don't know". They also made provision for respondents to rate their degree of certainty with each item along a five point scale. This method of weighted scoring has also been used to assess the nutrition knowledge of women athletes (Werblow et al., 1978; Perron and Endres, 1985), elementary school teachers (Petersen and Kies, 1972), high school graduates (Schwartz, 1975), grocers (Stansfield and Fox, 1977), nurses (Vickstrom and Fox, 1976; Schwartz, 1976) and physical education majors (Cho and Fryer, 1974). While weighted scoring is intended to provide a wider range of possible scores, Sabers and White (1969) reported no advantage from use of this procedure. These authors concluded that the same advantages could be gained by adding more items or by selecting only the best items from a larger pool. Unweighted scoring also saves time and offers fewer possibilities for errors in calculating the scores. In addition, the resulting raw scores from a simpler scoring

system are probably easier to interpret.

Ross (1984) constructed a 100 question multiple choice test to assess changes in the nutrition knowledge of nursing students resulting from their participation in a nutrition course. The test was administered on the first (pretest) and last (post-test) days of the semester long class. The author noted a significant increase in students' knowledge post-test scores, when compared to their pretest performance, following the course completion. However, no criteria were stated for test development. Validity, reliability and item analysis data were not reported.

Krause and Fox (1977) determined physicians' nutrition knowledge using a mail questionnaire. Fifty-five knowledge questions were prepared and reviewed by nutritionists and dietitians to insure content validity. The final 55 item questionnaire was based solely on their recommendations. The instrument was not pretested and no reliability coefficient was reported.

The order of procedures used to develop valid and reliable nutrition knowledge tests also vary among investigators. Some researchers have pretested instruments to obtain reliability estimates and item analysis data before developing the final test form (Yetley and Roderuck, 1980; Fanslow et al., 1981; Bedgood and Tuck, 1983; Guiry and Bisogni, 1986). Others have obtained test data after administering the test to their study subjects (Dwyer et

al., 1970; Spitze, 1983; Singleton and Rhoads, 1984; Gorelick and Clark, 1985).

Of the articles reviewed, most investigators took steps to insure content validity of knowledge instruments by basing questions on sound nutritional principles and using subject matter specialists as content reviewers (Table 2).

Nutrition Knowledge Research

Nutrition educators would like to assume that those who know the basic concepts and principles of nutrition will be motivated to apply this knowledge in their food choices. Numerous studies have been reported which attempt to measure the nutrition knowledge of individuals. A variety of methods have been used: telephone interviews; true/false and multiple choice objective tests; person to person interviews with clients; and food games and puzzles with preschoolers.

Gorelick and Clark (1985) developed a nutrition education program for preschoolers that incorporated tasks appropriate to the children's cognitive level of development. To determine the children's understanding of the program content, pre- and post-tests measured how well the children could manipulate and respond to various foods or realistic plastic replicas of foods in a series of game-like tests. Children exposed to the six-week nutrition education program had significantly higher post-test scores than children who received no intervening

program in their early childhood learning center.

Boysen and Ahrens (1972) used a similar pre/post-test design to assess nutrition knowledge of second graders receiving a four-week nutrition education program. Students involved in the experimental program showed significant improvement in their post-test scores compared to children receiving no nutrition education. A questionnaire designed for parents to ascertain whether this newly acquired nutrition knowledge was applied in the home revealed that some improvements in the children's eating habits occurred. Lunches sent from home during the nutrition program were judged to be of poor quality, however, suggesting the whole family must be involved in efforts to improve children's food habits.

Graves et al. (1982) determined the nutrition knowledge of vegetarians and nonvegetarians matched for age, gender, residence and prior nutrition training. Vegetarians scored significantly higher on an 80 item test covering concepts related to basic nutrition (food sources, nutrient functions, absorption, metabolism), and vegetarian nutrition (protein complementarity, limiting amino acids, nutritional advantages and disadvantages) than did nonvegetarians. Vegetarians' nutrition knowledge was related to the degree of nutrition training but was independent of gender, length of time or type of vegetarianism practiced.

Spitze (1983) examined the nutrition knowledge of 100 males employed by a midwestern university in service and academic positions. The average score on a 280 item true/false knowledge test was 65 percent. No significant correlation existed between knowledge scores and age, educational level or the men's participation in food shopping, food preparation or label reading activities. The latter finding differs from Woolcott et al. (1981), who noted a positive correlation between knowledge scores and participation in food-related activities of men employed in management and executive positions. Other investigators (Fusillo and Beloian, 1977; Yetley and Roderuck, 1980) reported low scores on nutrition knowledge tests administered to adult males.

In contrast to Spitze (1983), other studies have found knowledge scores significantly correlated with age, both positively and negatively. Woolcott et al., (1981) using executive level men, found higher nutrition knowledge associated with increasing age, while Fusillo and Beloian (1977) found less knowledge associated with increasing age in a group of adult male consumers. Also unlike Spitze, Woolcott et al. (1981) and Fusillo and Beloian (1977) reported educational levels were positively correlated with nutrition knowledge.

Cho and Fryer (1974) administered a 50 item true/false test of general nutrition knowledge, food composition and misconceptions to college physical education (PE) majors

and basic nutrition students. Nutrition knowledge scores for the PE students were significantly lower than those of the nutrition group. PE students considered high school and college courses, parents and coaches as their primary sources of nutrition knowledge, while nutrition students rated college courses highest. Students who ranked college courses as their primary source of nutrition knowledge had significantly higher test scores than those who ranked coaches or parents as their primary sources.

Athletic coaches' influence on dietary practices of young athletes led Bedgood and Tuck (1983) to investigate the nutrition knowledge of high school coaches. Eighty-six percent of the coaches surveyed dispensed nutrition information regularly, yet scores on a 43 item nutrition knowledge test ranged from 28 - 84%, with a mean score of 55%. Eighty-five percent of the coaches scored below 70%, suggesting a need for better nutrition education for coaches and trainers.

Knowledge, Attitudes and Behavior

Traditionally, social psychologists propose a three-phase process to explain behavior change. It begins with knowledge acquisition, which leads to attitude changes, which in turn influence one's behavior. The assumed role of education is to initiate the information-gathering process which then produces attitude shifts and finally induces behavior modification (Swanson,

1972). This process is summarized as follows:

Education ---> Knowledge ---> Attitudes ---> Behavior

According to Swanson (1972), the assumed relationship among knowledge, attitudes and behavior specifies that as a person receives more information on a subject (s)he begins to develop a "belief" about it. Eventually, (s)he would evaluate the subject as "good" or "bad", or "favorable" or "unfavorable", thus adopting an attitude position. Using a nutrition and health example, the model would predict the process as follows: (1) the accumulation of information on the negative effects of consuming a poor diet would come to be believed by a person; (2) (s)he would reevaluate his/her dietary practices, viewing them as something associated primarily with "bad" or "unfavorable" health consequences rather than "good" or "favorable" consequences; and (3) noting the inconsistency between his/her attitudes that (s)he developed from what (s)he knows about nutrition and the fact that (s)he still consumes a poor diet, the person will change his/her behavior to bring it more in line with his/her attitudes, i.e., to improve dietary habits. Thus, the paradigm that knowledge (K) precedes attitudes (A) which precede behavior (B) changes has been based on creating dissonance within the person's mind so that (s)he will change behavior to be consistent with the information (s)he knows and the attitudes (s)he holds (Swanson, 1972).

This three step sequence, K ---> A ---> B, has been challenged in recent years. While Cohen (1964) believes

that attitudes always precede behavior, Wicker (1969) suggests that attitudes are but one of many factors influencing behavioral outcome. Reservations about the K ---> A ---> B paradigm are related to the realization that attitudes are resistant to change and that a person's behavior may in fact change before attitudes (Swanson 1972).

Behavior typically has multiple causes. Nutrition-related behaviors are likely a combination of internal influences such as nutrition knowledge, attitudes and personality characteristics, and external factors such as cultural expectations, food availability, food costs, advertising appeals, food popularity and the desire to be similar to peers (Johnson and Johnson, 1985a). The view that nutrition knowledge and attitudes will determine nutrition behavior oversimplifies the complexity involved in food selection, preparation and consumption. Nevertheless, a substantial amount of research has examined people's knowledge and attitudes about nutrition, and some studies have attempted to relate these variables to behavior. Conflicting reports exist regarding their relationships.

In a study of nutrition knowledge, attitudes and practices of high school graduates, Schwartz (1975) found a significant correlation between knowledge and attitudes, and between attitudes and practice, but none between knowledge and practice. Similar findings were noted when

Strobl and Groll (1981) examined the knowledge, attitudes and practices of vegetarians.

Positive and significant correlations between nutrition knowledge and dietary behavior were observed in twelve- to fourteen-year-old girls (Hinton et al., 1963), homemakers (Young et al., 1956), mothers of preschool children (Eppright et al., 1970; Caliendo and Sanjur, 1978), and lactating women (Sims, 1978). Conversely, the correlation between knowledge and practice was not significant in fourth and fifth grade children (Baker, 1972; Bell and Lamb, 1973), high school athletes (Douglas and Douglas, 1984), and elderly persons (Grotkowski and Sims, 1978).

Several researchers found that favorable attitudes toward nutrition consistently correlated with higher nutrient intakes (Jalso et al., 1965; Baird and Schutz, 1980). In contrast, Grotkowski and Sims (1978) noted significant negative correlations between nutrient intake and attitudes related to fad diets and vitamin/mineral supplement use in elderly subjects. Age and attitude were the best predictors of dietary behavior when studying behavior change among nutrition education assistants in Missouri's Expanded Food and Nutrition Education Program (Carruth et al. 1977). Petersen and Kies (1972), using elementary teachers, also reported that attitude influenced behavior independently of the individual's knowledge of nutritional concepts and practices.

Neither nutrition knowledge nor attitudes greatly influenced the food practices of female athletes (Perron and Endres, 1985). However, knowledge and attitudes were positively and significantly correlated, indicating that the more nutrition knowledge an athlete had, the more positive the attitude toward nutrition. This study confirmed earlier findings on the positive relationship between nutrition knowledge and attitudes of women athletes (Werblow et al., 1978).

Recently, Guiry and Bisogni (1986) studied how the amount of caffeine consumed from beverages was related to knowledge and attitudes about caffeine. They found no relationship between knowledge about caffeine and attitude toward the importance of nutrition, but observed a negative association between knowledge about caffeine and attitude toward the use of caffeine during pregnancy. Caffeine consumption was independent of knowledge about the caffeine content of beverages.

Johnson and Johnson (1985b) reviewed the relationship between dietary behavior and food and nutrition-related knowledge and attitudes by using meta-analysis. Glass et al. (1981) defined meta-analysis as the process of combining results of independent experiments for the purpose of integrating their findings. Meta-analysis is conducted on a group of studies with a common conceptual hypothesis or common operational definitions of independent or dependent variables. Thus meta-analysis is applicable

to nutrition education research because of the large body of literature addressing the measurement of nutrition knowledge, attitudes and behavior. Meta-analysis techniques have been developed to allow researchers to quantitatively address two questions: (1) Is there a relationship between two variables? (2) What is the strength of the relationship?

The procedure used by Johnson and Johnson (1986b) included 303 studies yielding 4,108 findings that met the criteria of measuring food and nutrition-related attitudes and knowledge and dietary intake for the same individual. Meta-analysis results clearly indicated that nutrition education, as described in journal research articles, has been effective in promoting nutrition knowledge, positive nutrition attitudes and in increasing consumption of nutritious foods. Significant relationships existed between nutrition knowledge and behavior, and between nutrition attitude and behavior. The relation between nutrition knowledge and attitudes did not reach statistical significance.

In a meta-analysis of nine research articles examining the nutrition knowledge-behavior and attitude-behavior relationship, Axelson et al. (1985) also noted a correlation between these variables. Assessment of the relationship between nutrition knowledge and attitudes was not included in this procedure.

The study reported herein was designed to assess the food preservation knowledge and attitudes of clientele enrolled in the CES Master Canner program. Control subjects consisted of consumers with expressed interests in home food preservation who were not current participants in the Master Canner program. A 30 item food preservation knowledge test and 17 item Likert format attitude questionnaire were administered to all subjects. Established methods of knowledge test and attitude scale construction were used with appropriate steps taken to insure validity and reliability of the instruments.

METHODS

This chapter will outline the experimental design used in this research with attention given to controlling variables which may threaten the internal or external validity of the results. Methods and procedures used to recruit study subjects will be presented. A detailed section on "Instrumentation" will outline steps taken to insure validity and reliability of the food preservation knowledge test and attitude questionnaire developed for data collection. Data analysis procedures and tests of statistical significance used for group comparisons will be discussed.

Human Use Approval

Prior to the initiation of this research a copy of the proposal was sent to the University Committee for Research Involving Human Subjects for review. Approval was granted and all subjects involved were invited to participate at will (Appendix A). A consent form was developed explaining the study's purpose and assuring participant confidentiality (Appendix B). A subject's signature on the consent form was taken as his/her written agreement to

participate. Since the proposed research involved Extension field staff, approval was also obtained from Dr. Doris Wetters, CES Assistant Director for Home Economics.

Recruitment of Subjects

Since Master Canner programs are conducted at the county level, EHE participation in this study was aggressively sought by the investigator. Requests for their help in conducting Master Canner programs were made through personal mailings to all EHEs, personal telephone contacts and articles placed in their monthly food and nutrition newsletter. Master Canner program promotion and subject recruitment were handled by EHEs within each county. Subjects for this study consisted of 57 clientele enrolled in CES Master Canner programs held in Allegan, Bay, Genesee, Iosco, Kent, Macomb, St. Clair, Washtenaw and Wayne counties between March and September, 1986 (Figure 1). A breakdown of program time frame and Master Canner participants by county is presented in Table 3.

A non-equivalent control group of 204 participants was generated from telephone logs of people contacting county Extension offices for food preservation information in 1985. To facilitate telephone log preparation, all county Extension home economists were provided with printed forms to record pertinent information including client name, address, telephone number and a summary of question content (Appendix C). Telephone forms were sent to EHEs in April

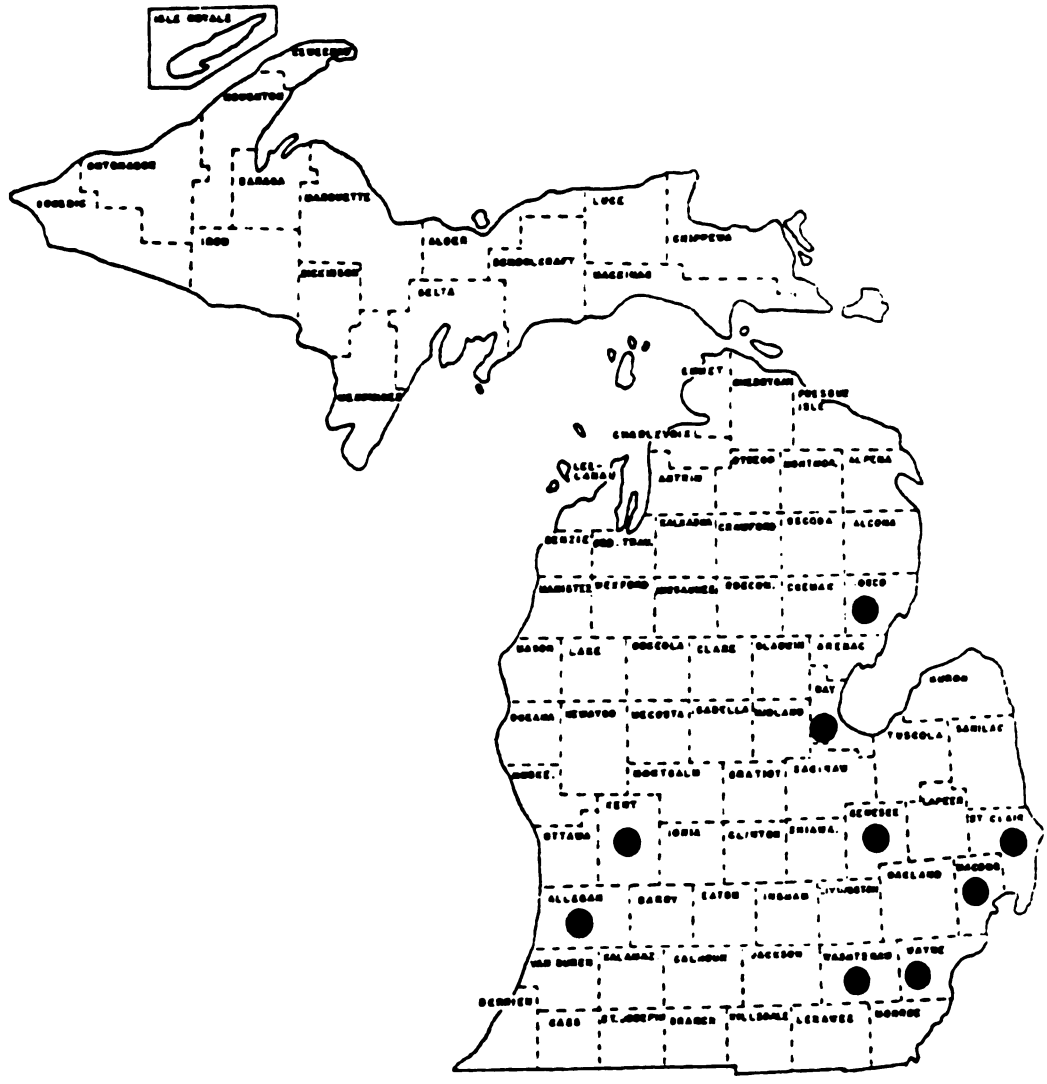


Figure 1. Michigan counties conducting Master Canner programs in which Master Canner volunteers were enrolled.

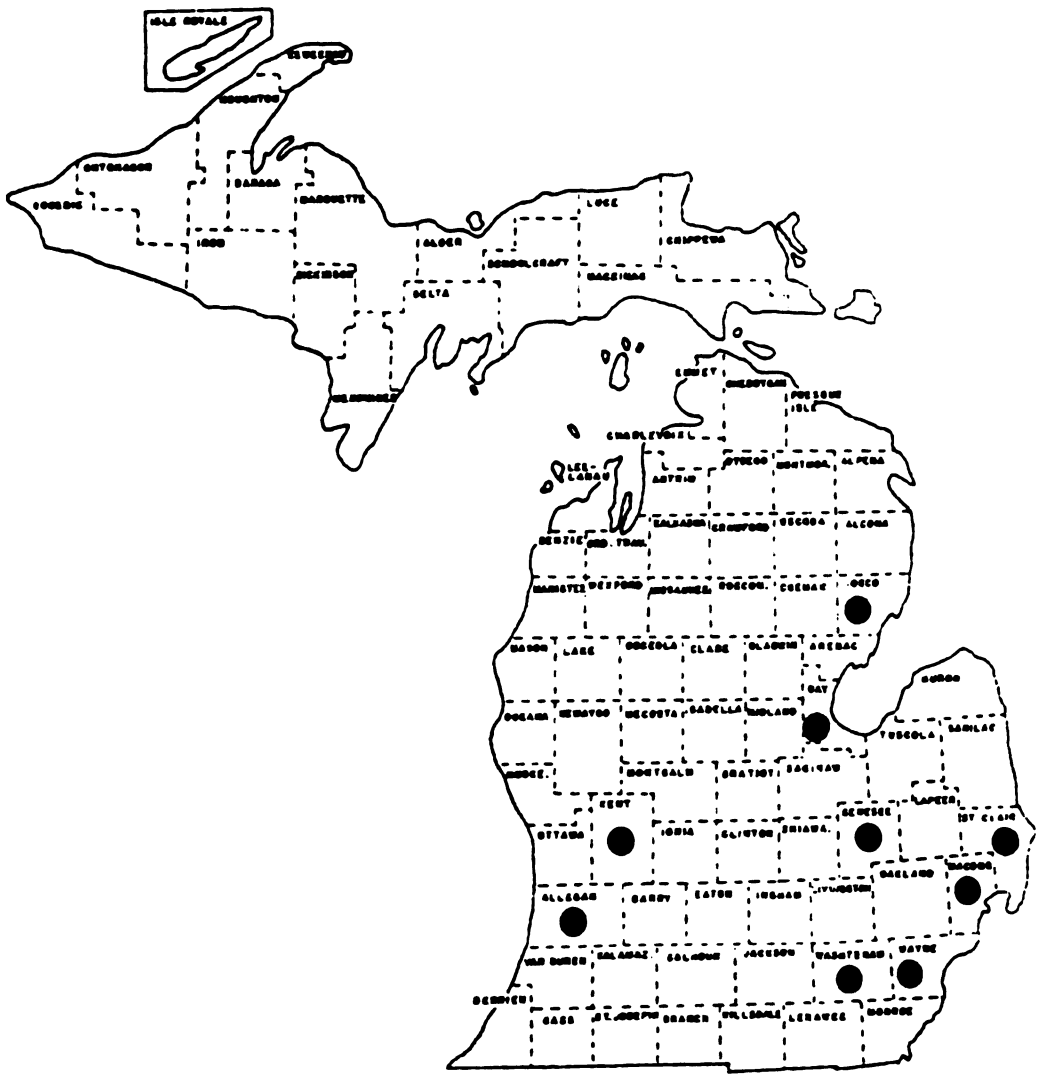


Figure 1. Michigan counties conducting Master Canner programs in which Master Canner volunteers were enrolled.

Table 3. Clientele enrollment in county Cooperative Extension Service Master Canner programs during 1986.

County	Program Date	Number of Participants
Allegan	July	4
Bay	July	6
Genesee	April - May	6
Iosco	August	3
Kent	May	5
Macomb	September	8
St. Clair	April - May	7
Washtenaw	July	10
Wayne	March - April	8
	Total	57

1985 so that calls to county offices during the peak 1985 food preservation season could be recorded.

To examine similarities between the treatment and control groups, general demographic information, including sex, occupation, age, educational level and place of residence, was collected. Background information was also collected on subjects' food preservation experiences and sources of food preservation information and training (Appendix D). Demographic and food preservation background information established whether both groups, although non-equivalent by assignment, were as alike as possible. Additionally, Master Canners were asked to answer two questions pertaining to their motivation for enrolling in the program: (1) Why did they sign up for the Master Canner program? and (2) Did the program's volunteer component influence their decision to participate? These questions were attached to the Supplemental Information questionnaire (Appendix D) as a separate form, to be completed by Master Canners along with the demographic and food preservation background information.

Requests for EHEs to send their completed telephone logs to the state office were made in July and November 1985, through the CES Food and Nutrition Newsletter. Logs which contained neither a client's address nor telephone number were discarded. Nine hundred thirty-eight usable client logs were received.

Potential control group subjects were initially

contacted by the investigator by telephone and asked to participate in this study. During the conversation the purpose of the study was explained and subjects were given the opportunity to ask questions. Names, addresses and telephone numbers of subjects agreeing to participate were recorded at the time of the call to verbally verify this information. Calls were made to potential subjects until 204 agreed to participate in the study. Consent forms were then mailed to these study subjects to confirm their participation. Control subjects were drawn from 21 counties in Michigan (Figure 2).

Experimental Design

The proposed experimental design for this research was a modification of the Solomon Four Group Design (Campbell and Stanley, 1963). A true Solomon design uses treatment and control groups that are subdivided into pre/post-tested and post-test only fractions (Figure 3). However, adjustments in the original pre- and post-test schedule were necessary in this study due to the small sample size of Master Canner program enrollees (n=57). To account for this limitation, all Master Canners were asked to complete a pre- and post-program food preservation knowledge test and attitude questionnaire (Figure 3). These program materials were administered to Master Canners at the beginning of their first class session, prior to any subject matter teaching by the EHE. The demographic and

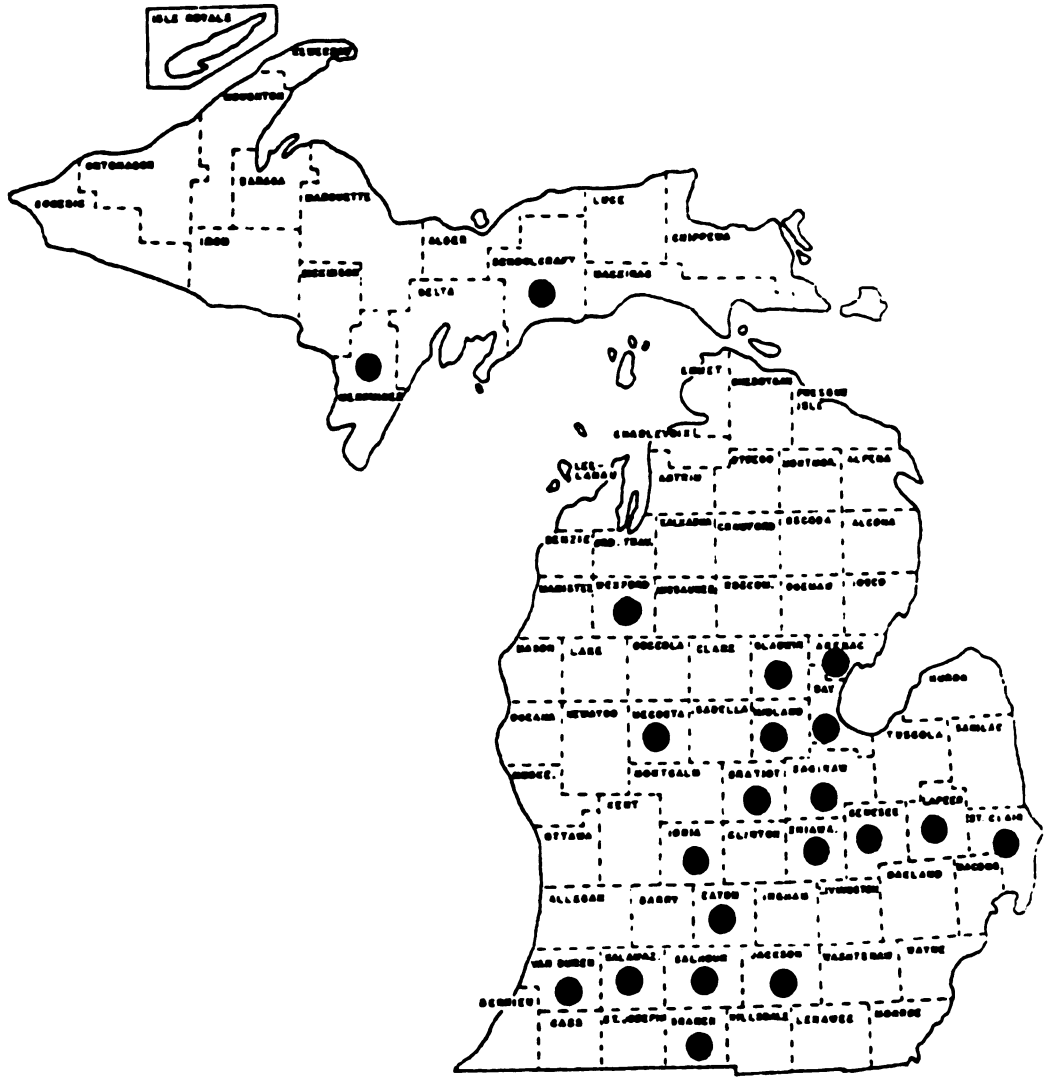
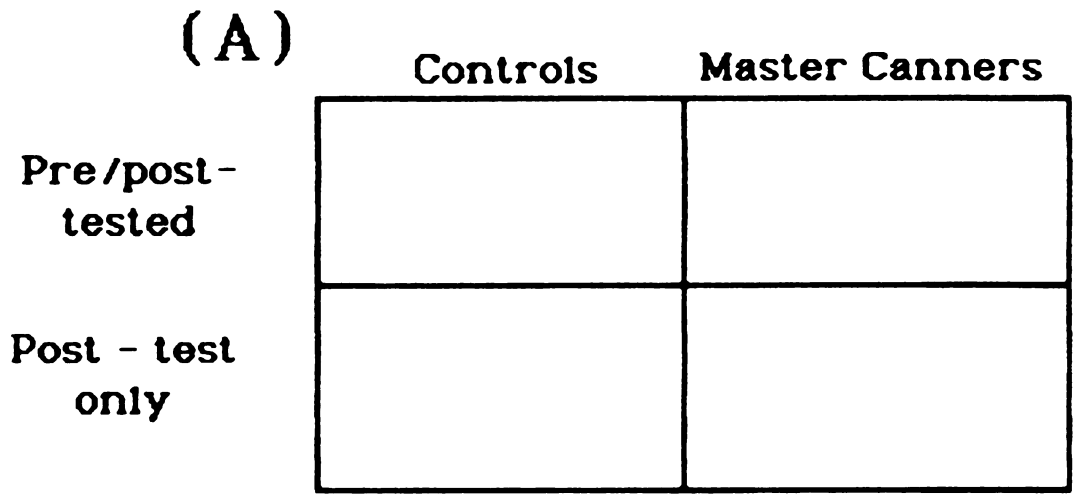


Figure 2. Michigan counties in which control group subjects were drawn for this study.



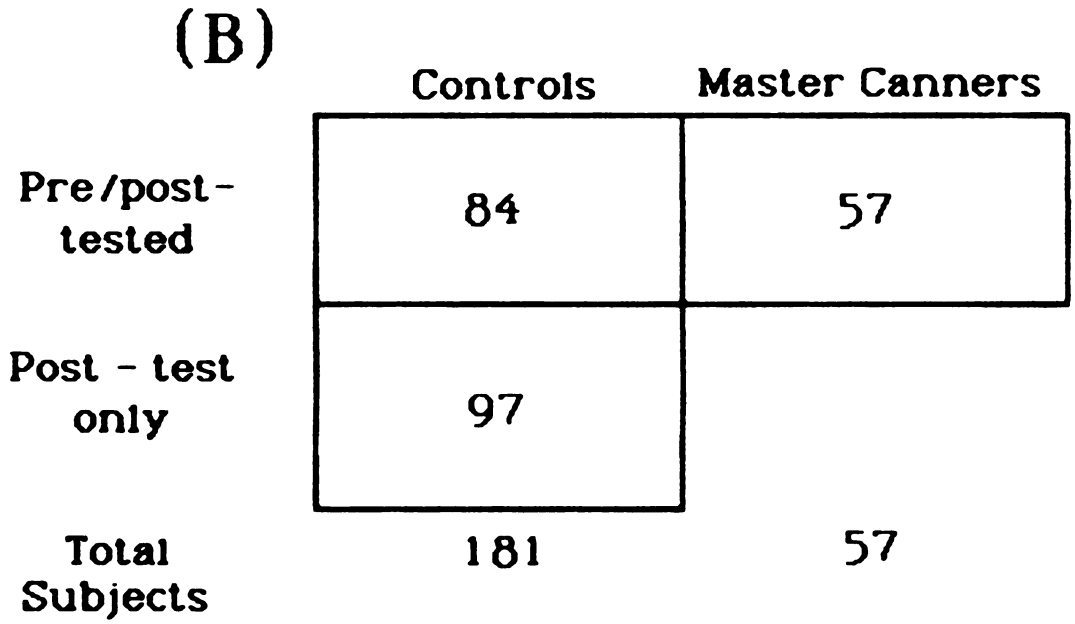


Figure 3. Comparison of the proposed Solomon Four Group Design (A) with the actual modified experimental design (B) used in this study.

food preservation background information form and additional questions related to motivation for program enrollment were also completed by all Master Canners at this time. Master Canners completed the post program knowledge test and attitude questionnaire at the end of their last class session.

Control group subjects were divided into two groups: (1) pre- and post-test, and (2) post-test only. This was accomplished by an April 1986 mailing of the demographic information and food preservation background form, food preservation knowledge test and attitude questionnaire to all control subjects. In the cover letter subjects were asked to complete and return the forms within a three week period. Each subject received a postage-paid, addressed envelope in which to return their completed materials. All forms were alphanumerically coded to determine when subjects returned the materials. Four subjects returned the materials uncompleted and asked to be withdrawn from the study, leaving a control group sample size of 200 participants. One hundred seventy six completed forms were received by the requested return date. One hundred control subjects were then randomly selected from this group to receive the post-program materials. Randomization was accomplished by generating a series of 100 random numbers between 1 and 176 using a Hewlett Packard HP 15C calculator. The 176 participant names were arranged in alphabetical order and the 100 names corresponding to the

order of random numbers were selected. These subjects were mailed the food preservation knowledge test and attitude questionnaire a second time in June 1986, constituting a "post-test" group with no intervening program.

A reminder letter was sent to the 24 subjects in the initial control group who failed to return their completed test and questionnaires by the requested date. Subsequently, five more completed forms were returned. Total sample size for the control "post-test only" group was 97 participants. Control subjects in the pre- and post-test group, receiving the food preservation knowledge test and attitude questionnaire twice at a six week interval, totaled 84.

Instrumentation

Prior to this research, certification of Master Canner volunteers was based on program attendance and passage of a written short answer, comprehensive final exam. The latter had been developed and implemented without evaluating its effectiveness. This section will detail methods used to develop the food preservation knowledge test and attitude questionnaire used in this research. Particular attention was given to developing valid and reliable instruments that were comprehensive in their treatment of subject matter and appropriate for use with Master Canners and control group subjects. Pilot testing of the instruments, prior to their use with study subjects, provided objective data as a basis for item revision and/or elimination.

Food Preservation Knowledge Test Development

Procedures used to develop the food preservation knowledge test items were adapted from Gronlund (1982) and Tinkleman (1971). Test question content was derived from current United States Department of Agriculture (USDA) home food preservation bulletins covering canning (Anon., 1977c; 1977e; 1983), freezing (Anon., 1976), drying (Anon., 1977d), pickling (Anon., 1978) and jam and jelly making (Anon., 1977b).

The intent of this study was to certify mastery of food preservation principles and procedures by clientele

enrolled in the Master Canner program. Hence, a summative evaluation approach was used. Test questions were written to represent key concepts in the subject matter material. An equal number of items were chosen from each food preservation area for a test representative of the content domain.

The cognitive domain of Bloom's taxonomy was used as a basis for identifying instructional objectives to be measured by the test (Appendix E). Questions were written to correspond with the first three cognitive levels: knowledge, comprehension and application.

Originally eight to ten knowledge test items were written covering each content area of the Master Canner program. Fifty five items were generated and subsequently subjected to professional review. In accordance with guidelines for test item construction, items were independent of one another, contained only plausible and attractive distractors, were free of irrelevant information, contained no verbal clues to the correct response and were stated in a positive form whenever possible.

Food Preservation Attitude Questionnaire Development

A Likert format attitude questionnaire was designed to measure certain food preservation-related attitudes of Master Canners and control group subjects. Original statements were written to correspond to four a priori

constructs:

I. Nutritional value of home preserved foods

II. Reasons for preserving foods at home

III. Importance of proper food preservation methods

IV. Food safety/food handling of home preserved foods

Edward's (1957) informal criteria for attitude statements were used as the basis for development of the items relating to each construct (Appendix F).

Establishment of Instrument Content Validity

Following development of the first draft of the food preservation knowledge test and attitude questionnaire, a professional review committee evaluated the instruments for content validity. Committee members, selected for their demonstrated interest in the development of appropriate food preservation materials for consumers, were contacted first by telephone to discern their interest in participating in the review. Those verbally agreeing were sent a formal letter requesting their professional assistance in evaluating the instruments along with a description of the Master Canner program and accompanying research study (Appendix G). The committee consisted of five CES food science and human nutrition specialists from other states and 2 doctoral students currently conducting food preservation research at Pennsylvania State University. Committee members reviewed knowledge test items for content, clarity and appropriateness for the

intended audience. In addition, they ranked all questions within each content section in priority order. High priority was to be given to items representing the knowledge base they felt was needed by Master Canner program participants to effectively assist the EHE with food preservation questions and programs.

Similarly, review team members evaluated the attitude statements for content, clarity and appropriateness for the intended audience. Using the five point Likert format (strongly agree to strongly disagree) members were asked to respond to each statement by selecting the response they felt would indicate the respondent held a positive attitude toward food preservation. A person with a "positive attitude" was described as "one who is cognizant of current recommended methods and employs them in preserving food; uses proper food safety and food handling techniques; avoids unsafe, unreliable or untested procedures and encourages the use of proper methodology by others".

Based on input from the review committee, 14 knowledge test questions required minor modifications to improve clarity. Reviewer ranking scores were then averaged and the five highest priority questions within each content area (except canning) were selected for inclusion on the pilot version of the knowledge test. The top ten questions were chosen for canning due to the extensive amount of material included in this general heading. Thus, the final pilot test version of the food preservation knowledge test

contained 30 questions. Content area questions were arranged so that each question was preceded and followed by one from a different food preservation category.

Attitude statements which showed common agreement on the attitude scale (either agree-strongly agree or disagree-strongly disagree) among all reviewers were chosen for inclusion on the pilot test version of the attitude questionnaire. Of the original 36 attitude statements, six were eliminated due to reviewer disagreement over how the item should be answered. Six of the remaining items required minor modifications to improve their clarity. The attitude response judged by the review team, in either a positive (agreement) or negative (disagreement) direction was also used as a basis for determining how each statement would be scored on the final questionnaire. A value of 5 points was given to the "strongly agree" or "strongly disagree" attitude depending on how an item was rated by the review team. Values of 4, 3, 2 and 1 were then assigned to the remaining categories in descending order. As with the food preservation knowledge test, the order of attitude statements was mixed by construct on the final pilot test version to minimize a response set by the subjects.

Demographic Questionnaire Development

The Supplemental Information questionnaire presented in Appendix D requests information relating to a subject's

personal background and food preservation experience. Personal background questions were adapted from previously used surveys (Warwick and Lininger, 1975; Warner and Christenson, 1984). Food preservation questions were designed to assess past experiences, present practices and sources of food preservation information. All supplemental information questions were reviewed by the investigator's doctoral committee prior to their use in pilot testing.

Instrument Pilot Testing

Following expert review and subsequent instrument revisions, the investigator pilot-tested the food preservation knowledge test and attitude and supplemental information questionnaires with 196 adults to determine face validity. Participating in the pilot test were subjects expected to have adequate food preservation knowledge (previous graduates of the CES Master Canner program and EHEs) and those expected to be uninstructed in the principles and procedures of home food preservation (community nutrition graduate students and consumers attending a variety of CES food and nutrition related programming events).

Food preservation knowledge test pilot data underwent item analysis to evaluate the effectiveness of the questions (Ebel, 1979). A discrimination index was calculated for each item by subtracting the number of respondents in the uninstructed group who answered the item

correctly from the number in the instructed group who answered it correctly. Items having a discrimination index equal to or greater than .20 were desired. Twenty-five of the 30 pilot test questions met this criteria (Table 4).

Item difficulty was estimated by determining the percentage of respondents who answered a question correctly. An item difficulty index between 20 percent and 80 percent was desired. Twenty two questions on the pilot version of the food preservation knowledge test fell within this range (Table 4). Minor revisions were made on the thirteen test items not meeting the predetermined criteria for item difficulty and discrimination. Distractors were reworded or rewritten to improve their effectiveness. Modified items were then subject to informal review by MSU CES food and nutrition specialists and community nutrition graduate students for clarity and accuracy. Test reliability was calculated to be .85 using the Kuder Richardson 20 (1937) estimate of internal consistency.

Construct validity of the attitude scales was determined from pilot test results using factor analysis. Dr. Laura Sims, Administrator, Human Nutrition Information Service, USDA, and Dr. Fred Ignatovich, Professor, Educational Administration, Michigan State University served as consultants on the appropriate use of factor analysis procedures. Subjects' responses to attitude statements were number coded 5, 4, 3, 2 or 1 based on the response key generated by the expert review committee. The

Table 4. Discrimination and difficulty indicies for food preservation knowledge test items.

Test Item Number	1	2	3	4	5	6	7	8	9	10
Discrimination Index (a) (b)	0.21	0.25	0.33	0.1	0.63	0.21	0.54	0.5	0.46	0.63
Difficulty Index (a) (c)	77	87	80	92	65	85	65	66	77	60
Test Item Number	11	12	13	14	15	16	17	18	19	20
Discrimination Index	0.3	0.6	0.54	0.38	0.42	0.6	0.42	0.33	0.83	0.08
Difficulty Index	81	66	73	81	80	38	75	33	50	88
Test Item Number	21	22	23	24	25	26	27	28	29	30
Discrimination Index	0.46	0.66	0.42	0.16	0.33	0.08	0.16	0.54	0.25	0.54
Difficulty Index	52	63	79	75	58	96	92	60	75	73

(a) - Index was obtained in pilot testing with 196 subjects

(b) - Discrimination Index = (Number of uninstructed respondents who answered item correctly minus number of instructed respondents who answered item correctly) divided by 196 (total number of subjects)

(c) - Difficulty Index = (Sum of all respondents who answered item correctly divided by 196 (total number of subjects)) X 100

factor analysis program of SPSS (Nie et al., 1975) was used to determine unidimensionality of the four scales. Nine factors were extracted initially using the method of principle factoring with iterations (Table 5). The number of factors to be retained was determined by: (1) extracting significant factors from the unrotated factor matrix; and (2) using the SCREE test (Cattell, 1966). Examination of the unrotated factor matrix revealed four factors with two or more significant factor loadings of .40 or greater. The SCREE test, conducted by plotting each factor against its corresponding eigenvalue (a criterion used to determine the relative importance of factors extracted from a variance-covariance matrix), indicated three, and possibly four, factors of importance (Figure 4).

The factor analysis program was rerun using varimax rotation and the four factor solution was examined first. Based on suggestions by Drs. Sims and Ignatovitch and a review of pertinent research papers using factor analysis for attitude item selection, criteria for final item selection included factor loadings of .40 or greater and communality values of .30 or greater. Nine items were deleted from the questionnaire that did not meet these specifications (Table 6). The remaining items were then grouped according to the highest loadings for a factor.

The six items pertaining to the original attitude construct "nutritional value of home preserved foods" loaded highly on factor two. No other items loaded

Table 5. Unrotated factor matrix containing factor loadings for 30 food preservation attitude scale items. *

Item Number	Factor 1**	Factor 2**	Factor 3**	Factor 4**	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9
1	0.563	-0.002	-0.232	-0.117	-0.172	0.124	0.083	0.077	0.178
2	0.613	-0.045	-0.196	-0.139	-0.258	0.182	-0.057	0.133	0.047
3	-0.121	0.325	0.299	0.001	0.259	0	0.369	0.098	-0.109
4	0.507	0.134	-0.257	-0.172	-0.194	0.107	0.034	0.031	-0.059
5	0.391	0.008	0.594	-0.223	-0.004	0.007	-0.125	-0.036	-0.167
6	0.484	-0.517	0.181	0.122	0.047	0.174	0.071	-0.017	-0.023
7	0.579	0.114	-0.152	0.014	0.09	-0.118	-0.054	0.256	-0.078
10	0.308	0.119	0.491	-0.087	-0.129	0.026	-0.289	-0.077	0.004
11	0.503	-0.484	0.033	0.191	-0.138	-0.212	-0.024	0.078	-0.084
12	0.343	0.139	-0.106	0.035	0.194	-0.217	0.1	0.105	-0.081
13	-0.172	-0.182	0.027	0.218	0.445	0.212	-0.225	0.117	0.334
14	0.221	0.215	-0.122	0.483	0.065	0.094	0.005	-0.225	-0.15
16	0.494	-0.513	0.278	0.171	0.003	0.312	0.217	-0.004	-0.049
17	0.532	0.28	0.464	-0.15	-0.014	-0.128	-0.059	-0.046	0.098
18	0.014	0.55	0.151	0.231	-0.124	-0.011	0.156	-0.026	0.224
19	0.193	0.026	-0.12	-0.042	-0.089	-0.156	-0.052	-0.204	0.161
20	0.391	-0.046	-0.139	-0.04	0.305	-0.057	0.048	-0.278	-0.106
21	0.057	-0.511	-0.059	0.272	-0.051	-0.175	0.016	0.149	-0.029
22	0.637	0.296	0.046	-0.018	0.199	-0.09	-0.046	0.127	0.012
23	0.149	0.364	0.12	-0.017	0.102	0.189	0.05	0.067	0.042
24	0.274	0.14	-0.082	0.007	0.015	0.071	-0.028	0.05	-0.138
25	0.61	0.089	-0.117	-0.145	0.183	-0.084	0.085	-0.214	0.151
26	0.358	-0.52	0.168	-0.005	-0.047	-0.261	-0.004	0.066	0.058
27	0.37	0.408	-0.154	0.542	-0.112	0.113	-0.228	-0.045	-0.072
29	0.637	-0.09	-0.212	-0.133	-0.042	0.118	0.237	-0.152	0.049
30	0.551	0.116	-0.126	-0.036	0.082	-0.205	-0.093	-0.001	0.138
31	0.283	-0.507	0.22	0.252	0.026	0.037	0.026	-0.114	0.122
32	0.421	0.121	-0.159	-0.049	0.186	0.249	-0.205	-0.026	-0.184
33	0.094	0.544	0.218	0.32	-0.274	-0.002	0.147	0.009	0.05
34	0.385	0.261	0.034	0.091	0.118	-0.028	0.078	0.232	0.047

* Data obtained using factor analysis program of SPSS (Nie et al., 1975)

** Factors containing 2 or more factors loadings of 0.4 or greater

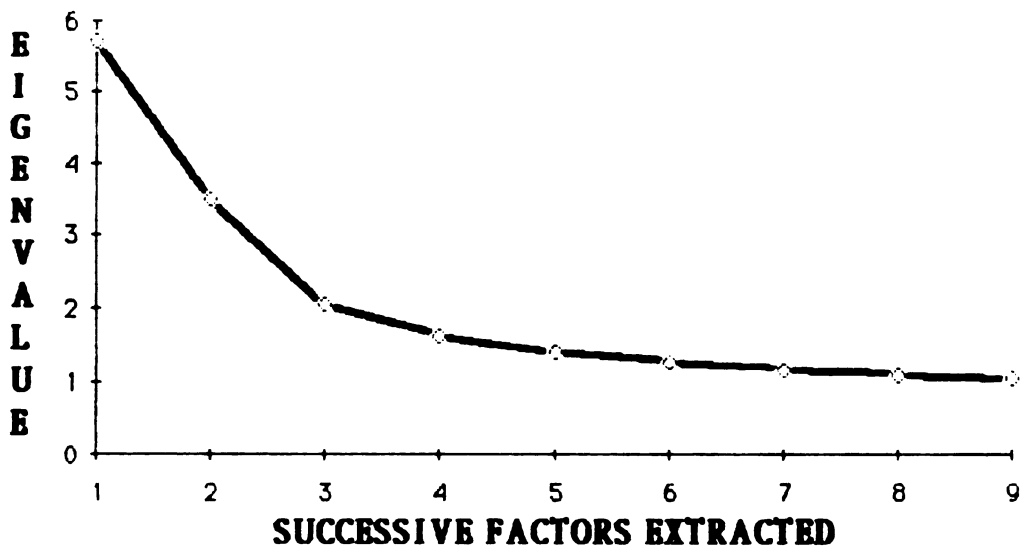


Figure 4. Graphic representation of the Scree test used to determine the number of significant factors to extract through factor analysis.

Table 6. Varimax rotated factor matrix containing factor loadings and communality values for 30 food preservation attitude scale items. *

Item Number	Factor 1	Factor 2	Factor 3	Factor 4	Communality
1	0.599	0.132	0.013	-0.001	0.377
2	0.616	0.185	0.054	-0.028	0.418
3**	-0.163	-0.225	0.27	0.137	0.17
4	0.606	-0.025	0.027	0.01	0.369
5	0.127	0.152	0.72	-0.06	0.562
6	0.207	0.697	0.122	-0.07	0.549
7	0.563	0.112	0.087	0.165	0.365
10	0.08	0.116	0.554	0.054	0.33
11	0.273	0.666	-0.009	0.017	0.518
12**	0.345	0.017	0.052	0.154	0.146
13**	-0.202	0.114	-0.115	0.005	0.067
14	0.151	0.066	-0.089	0.535	0.321
16	0.172	0.693	0.175	-0.029	0.542
17	0.318	0.053	0.7	0.119	0.608
18	-0.024	-0.301	0.23	0.472	0.368
19**	0.223	0.017	-0.017	0.016	0.051
20**	0.38	0.143	0.011	0.005	0.165
21	-0.081	0.52	-0.26	-0.009	0.345
22	0.566	0.025	0.337	0.238	0.492
23**	0.139	-0.209	0.263	0.189	0.168
24**	0.29	-0.017	0.056	0.124	0.103
25	0.603	0.097	0.161	0.03	0.4
26	0.137	0.595	0.097	-0.186	0.417
27	0.304	-0.016	-0.016	0.677	0.552
29	0.639	0.229	0.03	-0.042	0.463
30	0.544	0.087	0.116	0.12	0.331
31	-0.012	0.671	0.058	0.016	0 455
32**	0.444	0.015	0.058	0.077	0.207
33	-0.012	-0.213	0.282	0.559	0.438
34**	0.328	-0.01	0.203	0.27	0.222

* Data obtained using factor analysis program of SPSS (Nie et al., 1975)

** Items deleted from the attitude questionaire based on factor loadings of 0.40 or less and/or communality values of 0.30 or less

significantly on this factor, hence the original construct name was retained for the final scale.

Factor one contained eight items comprised of a mixture of three statements originally written under the construct "importance of proper food preservation methods" and five statements originally written under the "food safety/food handling of home preserved foods" construct. Careful examination of these original statements revealed an underlying theme of food safety and appropriate methodology within each. The scale for these combined items was named "preserving foods properly and safely" to reflect this theme.

Factor three contained three items pertaining to pressure canning. Although these items were originally grouped under the "importance of proper food preservation methods" construct, their content similarity produced enough consistently similar responses from pilot test subjects to form a single factor. The scale pertaining to these items was named "use of pressure canning for home preserved foods".

While a fourth factor was formed with factor loadings and communalities exceeding the preset criteria, the four corresponding items grouped as an individual scale, were conceptually uninterpretable. Two of the items corresponded with the "reasons for preserving foods at home" construct, while one each related to "importance of proper food preservation methods" and "food safety/food

handling of home preserved foods". Upon reexamination of the rotated factor matrix it was noted that three of the four items also loaded highly on one or more factors. Because of this discrepancy, the factor analysis program with varimax rotation was rerun with output limited to three factors. This was done to determine whether variance in these items could be significantly explained by one of the three other factors. The resulting three factor solution factor matrix produced communalities of .28 or less and factor loadings of .42 or less for these four items (Table 7). Based on these results, the four items were deleted from the final questionnaire. The final varimax rotated factor matrix, containing factor loadings grouped by magnitude for the 17 items used in data collection, is given in Table 8.

Cronbach's (1951) alpha reliability estimates were determined for the three remaining attitude scales following the factor analysis procedures used to ascertain scale unidimensionality. Reliability coefficients of .82, .81 and .75 were obtained for the "preserving foods properly and safely", "nutritive value of home preserved foods" and "use of pressure canning for home preserved foods" scales, respectively. Additional item deletions were not indicated to improve scale reliabilities. Reliability coefficients of .75 or above are considered acceptable for the purposes of group measurement (Tinkleman, 1971).

Table 7. Varimax rotated factor matrix containing factor loadings and communality values for 21 food preservation attitude scale items. *

Item Number	Factor 1	Factor 2	Factor 3	Communality
1	0.611	0.163	-0.006	0.4
2	0.615	0.217	0.05	0.429
4	0.582	0.012	0.012	0.34
5	0.075	0.145	0.696	0.511
6	0.2	0.681	0.176	0.535
7	0.581	0.081	0.113	0.358
10	0.064	0.063	0.607	0.377
11	0.285	0.62	0.079	0.472
14**	0.264	-0.116	0.048	0.085
16	0.195	0.67	0.205	0.53
17	0.323	-0.002	0.707	0.605
18**	0.107	-0.456	0.257	0.286
21	-0.053	0.483	-0.186	0.271
22	0.6	-0.04	0.362	0.494
25	0.56	0.111	0.162	0.353
26	0.087	0.641	0.125	0.435
27**	0.422	-0.231	0.145	0.253
29	0.615	0.276	0.016	0.455
30	0.562	0.05	0.158	0.343
31	0.033	0.59	0.137	0.368
33**	0.139	-0.387	0.312	0.267

* Data obtained using factor analysis program of SPSS (Nie et al., 1975)

** Items deleted from the attitude questionnaire based on factors loadings of 0.40 or less and/or communality values of 0.30 or less

Table 8. Final varimax rotated factor matrix solution for the 17 food preservation attitude scale items used in data collection. *

Item Number	Factor 1	Factor 2	Factor 3
1	0.631	0.151	-0.01
2	0.633	0.198	0.053
4	0.601	-0.015	0.028
7	0.563	0.082	0.133
22	0.578	-0.018	0.373
25	0.577	0.09	0.183
29	0.636	0.253	0.176
30	0.557	0.044	0.176
6	0.196	0.702	0.138
11	0.264	0.652	0.045
16	0.184	0.716	0.152
21	-0.076	0.514	-0.226
26	0.114	0.601	0.114
31	0.005	0.652	0.086
5	0.086	0.133	0.741
10	0.056	0.085	0.605
17	0.324	0.02	0.703

* Data obtained using factor analysis program of SPSS (Nie et al., 1975)

Final Instrument Preparation

Following pilot test data analysis, the food preservation knowledge test and attitude and supplemental information questionnaires were prepared for use with Master Canners and control group subjects. All instruments were retyped and art work was added for attractiveness (Appendices D, H and I). Due to the elimination of 13 attitude items after pilot testing, it was necessary to rearrange the order of items on the final questionnaire. Attitude statements were mixed by construct to minimize chances of a response set by subjects. The order of statements on the supplemental information questionnaire and food preservation knowledge test did not change between the pilot test and final versions of the instruments.

Data Analysis

All data were analyzed on the MSU Cyber 750 computer using programs from the Statistical Package for the Social Sciences (SPSS) (Nie et al., 1975; Hull and Nie, 1981). Non-parametric statistical tests were employed since the data were not obtained through random sampling procedures. The 0.05 level of probability was used as the criterion for significance. Comparisons made between pre- and post-test scores for Master Canners and pre- and post-test scores of control group subjects were considered paired sample comparisons. Comparisons of pretest scores between Master Canners and control group subjects, post-test scores between these two groups and the post-test scores of pre/post-tested control group subjects versus post-test only controls were considered two independent sample comparisons. Frequencies and associated statistics were obtained for all variables for the total set of data.

Demographic and Food Preservation Background Variables

Due to the unequal sample sizes for Master Canners (n=57) and control group subjects (n=181), statistical comparisons were first made between controls receiving both pre- and post-test instruments (n=84) and those who received post-test only instruments (n=97). Chi-square tests were used to evaluate differences between these two groups on the demographic variables of sex, occupation and

place of residence and on all variables related to food preservation methods previously and presently used and sources of food preservation information and training (Zar, 1974). Differences between post-test only control group subjects and pre/post- tested controls for age, level of education and years of food preservation experience were analyzed by the Mann Whitney U test. Comparisons were then made between Master Canners and pre/post-tested control group subjects for all demographic and food preservation background variables. Chi-square and Mann Whitney U tests were employed for the variables as described above (Zar, 1974).

Food Preservation Knowledge Test

Answers to the food preservation knowledge test were hand scored by a student worker and double checked for accuracy by the investigator. Items were assigned a value of 1 or 0, reflecting either a correct or an incorrect response, respectively. The McNemar test was used to evaluate differences between knowledge pre- and post-test scores for Master Canners and control group subjects (Zar, 1974). Differences between knowledge pretest scores for Master Canners and for control group subjects were analyzed by a chi-square test. Similarly, chi-square tests were used to evaluate differences between post-test scores of these two groups and between post-test scores of pre/post-tested control group subjects and controls who

were post-tested only (Zar, 1974).

Food Preservation Attitude Questionnaire

Items on the food preservation Likert format attitude questionnaire were hand scored from 1 to 5 by a student worker and double checked for accuracy by the investigator. For the three attitude scales, the strongly disagree response was scored a 5 and the strongly agree response was scored a 1. Scores were then summed across the items in each scale. The highest scores possible were 15, 30 and 40 for the "use of pressure canning for home preserved foods", "nutritional value of home preserved foods" and the "preserving foods properly and safely" scales, respectively. For all scales, the higher the score the more positive or favorable the attitude being measured.

The Wilcoxon matched pairs ranked-signs test was used to evaluate differences between attitude pre- and post-test scores of each scale for Master Canners and for control group subjects (Zar, 1974). Differences between attitude scale pretest scores for Master Canners and control group subjects were analyzed by the Mann Whitney U test. Similarly, Mann Whitney U tests were used to evaluate differences between post-test scores of these two groups and between post-test scores of pre/post-tested control group subjects and controls who were post-tested only (Zar, 1974).

Relationships Between Variables

Kendall rank-order correlation coefficients were determined between knowledge and attitude scores and selected continuous demographic variables for Master Canners and pre/post-tested control group subjects. Nie et al. (1975) suggested the use of Kendall coefficients when data contain a large number of tied ranks. The value of Kendall coefficients vary from +1.0 to -1.0, but in general their absolute value tends to be smaller than those of Pearson's product moment correlations.

RESULTS AND DISCUSSION

Control Group Sample Characteristics

No significant differences existed between pre/post-tested control group subjects and controls who received post- test only materials for any demographic or food preservation background characteristics. This type of information was collected to establish that the Master Canners and control group subjects were as alike as possible in the absence of random sampling procedures frequently used to select treatment and control groups. A control group selected through random sampling would have facilitated a more powerful comparison with the Master Canners. Such sampling was not possible in this study, however, since the Master Canners willingly selected themselves into the program. A random sample of general consumers to serve as controls would not have constituted a similar comparison group since these people may or may not have an interest in home food preservation. Since the Master Canners share a common interest in food preservation, it was assumed that the control group (people calling county CES offices for food preservation information) generated for this study would have a similar interest.

Control group subjects were predominately females who were not employed outside the home. The post-test only control group had 96 (99%) females and 1 male (1%). Eighty-one (96%) of the pre/post-test control group subjects were female and 3 (4%) were male (Table 9). Sixty-eight (70%) post-test only control group subjects were homemakers, 7 (7%) were health professionals, 3(3%) were clerical employees, 3 (3%) were educators, 7 (7%) were business persons and 9 (10%) were in other non-professional occupations (Table 10). Fifty seven (68%) pre/post-tested control group subjects were homemakers, 6 (7%) were health professionals, 4 (5%) were clerical employees, 5 (6%) were educators, 9 (11%) were business persons and 3 (3%) were in other non-professional occupations (Table 10).

The majority of control group subjects were 25 to 44 years of age. Three (3%) post-test only control group subjects were less than 25 years old (Table 11). Twenty-five (26%) each were between 25 and 34 years and between 35 and 44 years old. Fifteen (15%) each were ages 45 to 54, and ages 55 to 64 years old. Fourteen (14%) subjects in this group were over 65 years old (Table 11). Two (2%) pre/post-tested control group subjects were less than 25 years old, 21 (25%) were between 25 and 34 years, 24 (29%) were between 35 and 44 years, 18 (21%) were 45 to 54 years old, 11 (13%) were 55 to 64 and 8 (10%) were 65 years and over (Table 11).

Table 9. Distribution of Master Canners and control group subjects by sex.*

Group	Female n (%) **	Male n (%)
Master Canners	51 (90)	6 (10)
Pre/post- test controls	81 (96)	3 (4)
Post-test only controls	96 (99)	1 (1)

* Groups did not differ significantly on this variable.
** n = number of subjects

Table 10. Distribution of Master Canners and control group subjects by occupation.

Occupation	Group		
	*Master Canners n (%) **	*Pre/post-tested controls n (%)	Post-test only controls n (%)
Homemaker	20 (35)	57 (68)	68 (70)
Health professional	6 (11)	6 (7)	7 (7)
Clerical employee	7 (12)	4 (5)	3 (3)
Educator	5 (9)	5 (6)	3 (3)
Businessperson	11 (19)	9 (11)	7 (7)
Other	8 (14)	3 (3)	9 (10)

* These two groups are significantly different, Chi-square = 16.50 (d.f.=5), $p<.01$.
** n = number of subjects

Table 11. Distribution of Master Canners and control group subjects by age range.

Age Range	Group		
	*Master Canners n (%) **	*Pre/post-tested controls n (%)	Post-test only controls n (%)
Less than 25 years	2 (4)	2 (2)	3 (3)
25 to 34 years	27 (47)	21 (25)	25 (26)
35 to 44 years	11 (19)	24 (29)	25 (26)
45 to 54 years	8 (14)	18 (21)	15 (15)
55 to 64 years	6 (11)	11 (13)	15 (15)
65 or over	3 (5)	8 (10)	14 (15)

* These two groups differed significantly, $p<.01$.
** n = number of subjects

Most control group subjects had completed at least a high school education. One (1%) post-test only control group subject had acheived an eighth grade or less education, 3(3%) had completed some high school, 48 (50%) were high school graduates, 26 (27%) completed some college courses, 9 (9%) were college graduates, 6 (6%) completed some post graduate courses and 4 (4%) had earned an advanced degree (Table 12). Two (2%) pre/post-tested control group subjects had an eighth grade or less education, 6 (7%) had completed some high school, 28 (33%) were high school graduates, 28 (33%) had completed some college courses, 13 (16%) were college graduates, 6 (7%) completed some post-graduate courses and 1 (1%) had earned an advanced degree (Table 12).

Of the post-test only control group subjects, 14 (14%) lived on a farm, 30 (31%) lived in a rural area, 29 (30%) came from a small town of less than 50,000 people, 14 (14%) from a suburban area and 10 (11%) lived in a city of 50,000 people or more (Table 13). In the pre/post-test control group, 16 (19%) lived on a farm, 29 (35%) in a rural area, 25 (29%) in a small town, 6 (7%) in a suburban area and 8 (10%) lived a city of 50,000 or more people (Table 13).

The amount of food preservation experience was similar among all control group subjects. One (1%) pre/post-tested control group subject had no previous food preservation experience. All post-test only controls had done some preserving (Table 14). Approximately one-third ($\geq$34%) of

Table 12. Distribution of Master Canners and control group subjects by highest level of education attained.

Level of education	Group		
	*Master Canners n (%) **	*Pre/post-tested controls n (%)	Post-test only controls n (%)
8th grade or less	0 (0)	2 (2)	1 (1)
Completed some high school	0 (0)	6 (7)	3 (3)
High school graduate	11 (19)	28 (33)	48 (50)
Completed some college	26 (46)	28 (33)	26 (27)
College graduate	9 (16)	13 (17)	9 (9)
Completed some postgraduate courses	6 (10)	6 (7)	6 (6)
Earned advanced degree	5 (9)	1 (1)	4 (4)

* These two groups differed significantly, $p<.01$.
** n = number of subjects

Table 13. Distribution of Master Canners and control group subjects by place of residence.

Location	Group		
	*Master Canners n (%) **	*Pre/post-tested controls n (%)	Post-test only controls n (%)
Farm	2 (4)	16 (19)	14 (14)
Rural area	13 (23)	29 (35)	30 (31)
Small town (<50,000 people)	8 (14)	25 (29)	29 (30)
Suburban area	16 (28)	6 (7)	14 (14)
Large city (>50,000 people)	18 (31)	8 (10)	10 (11)

* These two groups are significantly different, Chi-square = 30.06 (d.f.=4), p<.001.
** n = number of subjects

Table 14. Distribution of Master Canners and control group subjects by amount of food preservation experience.

Food preservation experience	Group *Master Canners n (%) **	*Pre/post-tested controls n (%)	Post-test only controls n (%)
No previous experience	9 (16)	1 (1)	0 (0)
Less than 6 months	11 (19)	1 (1)	3 (3)
6 months - 1 year	6 (10)	2 (2)	3 (3)
1 - 5 years	16 (28)	18 (22)	17 (18)
5 - 10 years	5 (9)	7 (8)	14 (14)
More than 10 years	10 (18)	55 (66)	60 (62)

* These two groups differed significantly, $p<.001$.
** n = number of subjects

control subjects had been preserving for one to 10 years while the majority of control subjects ($\geq$62%) had more than 10 years of food preservation experience.

Post-test only and pre/post-tested control group subjects did not differ with respect to the types of food preservation methods they had previously used. The majority of subjects in each group had tried freezing, water bath and pressure canning, pickling and jam or jelly making (Table 15). In contrast, approximately three-fourths (79%) of the subjects had never tried to dry foods.

Similarly, the two control groups did not differ with respect to the types of food preservation methods they currently use. Most subjects ($\geq$80%) were currently freezing foods. In contrast, drying was a method relatively few people ($\leq$8%) used (Table 16). Slightly more pre/post-tested control group subjects currently water bath can (60%) or make jam or jelly (52%) than do the post-test only controls for these two methods (47% respectively). Approximately half ($\geq$45%) of the subjects in each group currently pressure can while less than half ($\leq$42%) currently use pickling as a food preservation method (Table 16). One subject from each group was not currently preserving food.

Most control group subjects had a water bath canner ($\geq$81%), pressure canner ($\geq$61%) and freezer ($\geq$92%) readily available for their use (Table 17). In contrast, only 13

Table 15. Distribution of Master Canners and control group subjects by food preservation methods previously tried.

Group		Freezing n (%) **	*Water bath canning n (%)	Pressure canning n (%)	*Pickling n (%)	Drying n (%)	*Jam or jelly making n (%)
Master Canners	Previously tried	48 (84)	39 (68)	27 (47)	32 (56)	19 (33)	39 (68)
	Have not used	9 (16)	18 (32)	30 (53)	25 (44)	38 (67)	18 (32)
Pre/post-tested controls	Previously tried	80 (95)	78 (93)	57 (68)	69 (82)	18 (21)	74 (88)
	Have not used	4 (5)	6 (7)	27 (32)	15 (18)	66 (79)	10 (12)
Post - test only controls	Previously tried	95 (98)	86 (89)	62 (64)	73 (75)	20 (21)	89 (92)
	Have not used	2 (2)	11 (11)	35 (36)	24 (25)	77 (79)	8 (8)
Chi-square values between Master Canners and pre/post-tested control subjects (d.f.=1)		3.7 p>.05	12.67 p<.01	2.71 p>.05	10.05 p<.001	1.91 p>.05	7.06 p<.01

* Use of these methods differed significantly between Master Canners and pre/post-tested control subjects.
** n = number of subjects

Table 16. Distribution of Master Canners and control group subjects by food preservation methods currently used.

Group		Freezing n (%) **	*Water bath canning n (%)	*Pressure canning n (%)	*Pickling n (%)	Drying n (%)	*Jam or jelly making n (%)
Master Canners	Currently use	37 (65)	21 (37)	14 (25)	10 (17)	4 (7)	18 (32)
	Do not use	20 (35)	36 (63)	43 (75)	47 (83)	53 (93)	39 (68)
Pre/post-tested controls	Currently use	67 (80)	50 (60)	38 (45)	35 (42)	7 (8)	44 (52)
	Do not use	17 (20)	34 (40)	46 (55)	49 (58)	77 (92)	40 (48)
Post - test only controls	Currently use	85 (88)	46 (47)	48 (50)	29 (30)	6 (6)	46 (47)
	Do not use	12 (12)	51 (53)	49 (50)	68 (70)	91 (94)	51 (53)
Chi-square values between Master Canners and pre/post-tested control subjects (d.f.=1)		3.13 p>.05	6.11 p<.01	5.37 p<.05	8.01 p<.01	0.08 p>.05	5.14 p<.05

* Use of these methods differed significantly between Master Canners and pre/post-tested control subjects.
** n = number of subjects

Table 17. Distribution of Master Canners and control group subjects by availability of food preservation equipment.

Group		Type of equipment			
		*Water bath canner n (%) **	Pressure canner n (%)	*Freezer n (%)	Dehydrator n (%)
Master Canners	Available	36 (64)	32 (56)	41 (72)	8 (14)
	Not available	21 (36)	25 (44)	16 (28)	49 (86)
Pre/post-tested controls	Available	72 (86)	54 (64)	77 (92)	13 (15)
	Not available	12 (14)	30 (36)	7 (8)	71 (85)
Post-test only controls	Available	79 (81)	59 (61)	91 (94)	14 (15)
	Not available	18 (19)	38 (39)	6 (6)	83 (85)
Chi-square values between Master Canners and pre/post-tested control subjects (d.f.=1)		8.42 p<.01	0.63 p>.05	8.29 p<.01	0.05 p>.05

* Availability of this equipment differed significantly between Master Canners and pre/post-tested control group subjects.

** n = number of subjects

(15%) pre/post-tested control group subjects and 14 (15%) post-test only controls had ready access to a dehydrator. One post-test only control group subject reported having no food preservation equipment available for use. No pre/post-tested control subjects reported a problem with equipment availability.

The CES was cited as the most frequently used source for food preservation information by both control groups (Table 18). Seventeen to 23 percent of control group subjects always used an immediate family member for food preservation information, while relatives, neighbors or friends were listed as occasional information sources by approximately one half ($\geq$47%) of subjects (Table 18). The Ball Blue Book and/or Kerr Home Canning and Freezing Book were the most popular reference books used by either control group. Other books and food preservation information sources, such as radio, newspapers or magazines, were infrequently or never used by control group subjects (Table 18).

A high school or college home economics course was cited as the most frequent source of food preservation training for control group subjects ($\geq$23%) (Table 19). Eight (9%) pre/ post-tested controls and 15 (15%) post-test only control group subjects had received food preservation training in a 4-H foods and nutrition program. Six percent or less of control group subjects had received food preservation training from their mother or grandmother, an

Table 18. Distribution of Master Canners and control group subjects by food preservation information sources.

Source	Use Always n (%) *			Use Sometimes n (%)			Never Use n (%)			Did Not Specify n (%)		
	MC (a)	PPTC (b)	PTOC (c)	MC	PPTC	PTOC	MC	PPTC	PTOC	MC	PPTC	PTOC
Immediate family member	7 (12)	14 (17)	22 (23)	18 (32)	29 (34)	32 (33)	19 (33)	19 (23)	23 (24)	13 (23)	22 (26)	20 (21)
Relative	4 (7)	7 (8)	5 (5)	17 (30)	41 (49)	52 (54)	19 (33)	15 (18)	17 (17)	17 (30)	21 (26)	23 (24)
Neighbor/friend	2 (4)	2 (2)	4 (4)	18 (32)	39 (47)	48 (49)	21 (38)	16 (19)	21 (22)	16 (28)	27 (32)	24 (25)
Food preparation and/or preservation course	4 (7)	3 (4)	4 (4)	8 (14)	16 (19)	25 (26)	22 (39)	32 (38)	40 (41)	23 (40)	33 (39)	28 (29)
Cooperative Extension Service**	11 (19)	11 (13)	9 (9)	17 (30)	61 (73)	64 (66)	13 (23)	3 (4)	3 (3)	16 (28)	9 (10)	21 (22)
Ball or Kerr home food preservation guides	12 (21)	21 (25)	21 (22)	6 (11)	10 (12)	14 (14)	34 (60)	36 (43)	40 (41)	5 (8)	17 (20)	22 (23)
Cookbooks	6 (11)	7 (8)	6 (6)	1 (1)	6 (7)	6 (6)	48 (84)	64 (76)	77 (80)	2 (4)	7 (9)	8 (8)
Manufacturer's directions	1 (1)	10 (12)	9 (10)	1 (1)	1 (1)	5 (5)	52 (92)	66 (79)	73 (75)	3 (6)	7 (8)	10 (10)
USDA food preservation publications	0 (0)	1 (1)	1 (1)	0 (0)	1 (1)	2 (2)	54 (92)	80 (96)	91 (94)	3 (5)	2 (2)	3 (3)

Table 18. (cont'd)

Source	Use Always n (%) *			Use Sometimes n (%)			Never Use n (%)			Did Not Specify n (%)		
	MC (a)	PPTC (b)	PTOC (c)	MC	PPTC	PTOC	MC	PPTC	PTOC	MC	PPTC	PTOC
Popular press books	11 (19)	6 (7)	8 (8)	3 (5)	6 (7)	5 (5)	39 (69)	63 (75)	79 (82)	4 (7)	9 (11)	5 (5)
Newspapers or magazines	2 (4)	2 (2)	1 (1)	4 (7)	2 (2)	5 (5)	50 (88)	76 (91)	87 (90)	1 (1)	4 (5)	4 (4)
Radio	0 (0)	0 (0)	1 (1)	2 (4)	0 (0)	0 (0)	54 (95)	83 (99)	96 (99)	1 (1)	1 (1)	0 (0)

* n = number of subjects
(a) - Master Canners
(b) - Pre/post-tested control group subjects
(c) - Post-test only control group subjects
** Use of this food preservation information source differed significantly between Master Canners and pre/post-tested control group subjects.

Table 19. Distribution of Master Canners and control group subjects by sources of food preservation training.

Sources	Received training n (%) *			No training n (%)		
	MC (a)	PPTC (b)	PTOC (c)	MC	PPTC	PTOC
Adult education class	1 (1)	3 (4)	3 (3)	56 (99)	81 (96)	94 (97)
Home economics course**	4 (7)	29 (35)	22 (23)	53 (93)	55 (65)	75 (77)
4-H foods and nutrition program	5 (9)	8 (9)	15 (15)	52 (91)	76 (91)	82 (85)
Mother or grandmother	1 (1)	4 (5)	3 (3)	56 (99)	80 (95)	94 (97)
CES correspondence course	0 (0)	1 (1)	1 (1)	57 (100)	83 (99)	96 (99)
CES workshop or update (1-2 days)	3 (5)	3 (4)	6 (6)	54 (95)	81 (96)	91 (97)

* n = number of subjects
(a) - Master Canners
(b) - Pre/post-tested control group subjects
(c) - Post-test only control group subjects
** Use of this food preservation training source differed significantly between Master Canners and pre/post-tested control group subjects.

adult education class or a CES correspondence course or workshop. Sixty-five percent or more of pre/post-tested controls and 77% or more of post-test only controls had not received prior food preservation training (Table 19).

Master Canner Sample Characteristics

Since no significant demographic or food preservation background differences were noted between the two groups of control participants, further comparisons were made between Master Canners and the pre/post-tested control group subjects on these characteristics. Through the sampling technique used in this study, it was assumed that these two groups differed only by the Master Canners participation in the comprehensive CES food preservation training program. However, statistical analysis revealed that several significant demographic and food preservation background differences existed.

Significant differences were noted in the occupations of Master Canners and the pre/post-tested control group subjects. Twenty (35%) Master Canners, approximately one-third of the sample, were homemakers while 37 (65%) were employed in a variety of other occupations - - 6 (11%) were health professionals, 7 (12%) were clerical employees, 5 (9%) were educators, 11 (19%) were business persons and 8 (14%) were in other non-professional occupations (Table 10). In contrast, more than two-thirds (68%) of the control subjects were homemakers with the remaining 32% employed in

other occupations (Table 10).

The ages of Master Canners were significantly different from the pre/post-tested control group subjects. Approximately half (51%) of the Master Canners were age 34 or below - two (4%) Master Canners were less than 25 years old and 27 (47%) were between 25 and 34 years (Table 11). Of the remaining 49%, 11 (19%) Master Canners were between 35 and 44 years, 8 (14%) were between 45 and 54 years, 6 (11%) were between 55 and 64 years and 3 (5%) were age 65 or over. By comparison, half (50%) of the pre/post-tested control subjects were between 35 and 54 years, with approximately one-quarter (27%) of subjects below 35 years and one-quarter (23%) above 54 years old (Table 11).

Significant differences were noted in the educational level of Master Canners and the pre/post-tested control group subjects. All Master Canners had at least a high school education - 11 (19%) were high school graduates, 26 (46%) had completed some college courses, 9 (16%) were college graduates, 6 (10%) completed some postgraduate courses and 5(9%) had earned an advanced college degree (Table 12). In contrast, 8 (10%) control group subjects had less than a high school education and only 1 (1%) had earned an advanced college degree (Table 12).

Place of residence differed significantly between Master Canners and the pre/post-tested control group subjects. Eighty-three percent of control group subjects lived on a farm, in rural areas or in small towns of less

than 50,000 people (19%, 35% and 29%, respectively) (Table 13). By comparison, more than half (59%) of the Master Canners lived in suburban areas or large cities of 50,000 or more people (28% and 31%, respectively). Only 2 (4%) Master Canners lived on a farm with 13 (23%) from a rural area and 8 (14%) from a small town (Table 13).

Master Canners and pre/post-tested control group subjects differed significantly in amount of food preservation experience. Seventy-three percent of Master Canners had been preserving food for 5 years or less, whereas, 74% of control group subjects had been preserving for more than 5 years (Table 14).

Significant differences were found in the use of several food preservation methods previously tried by Master Canners and pre/post-tested control group subjects. Significantly more control subjects had previously water bath canned, pickled or made jam or jelly than Master Canners (Table 15). No differences were found between Master Canners and controls who had used freezing, pressure canning or drying in the past to preserve foods. Freezing had been used by most participants ($\geq$84%), whereas, only one-third or less from each group had tried to dry foods (Table 15). More control subjects (68%) had tried to pressure can than had Master Canners (47%).

Similarly, Master Canners and controls differed significantly in their current use of water bath canning, pickling and jam or jelly making (Table 16).

Significantly more control subjects were using these methods than were Master Canners. A similar trend was noted in the use of pressure canning by controls as compared to Master Canners. No differences were found between Master Canners and controls in their current use of freezing or drying to preserve foods. Freezing was used by a large percentage of both groups ($\geq$65%) while drying was rarely used ($\leq$8%) (Table 16).

The types of food preservation equipment readily available for use by Master Canners and pre/post-tested control group subjects differed significantly. A significantly larger number of controls had access to a freezer and water bath canner than did Master Canners (Table 17). No differences were found in the availability of pressure canners or dehydrators. Slightly more than half ($\geq$56%) of the subjects in each group had a pressure canner available for use. Only 13 (15%) controls and 8 (14%) Master Canners had access to a food dehydrator.

Significantly more pre/post-tested control group subjects (86%) used the CES for food preservation information than did Master Canners (49%) (Table 18). While immediate family members, relatives, neighbors and friends were also listed as frequent sources for food preservation information, no significant differences were found between the groups for these sources. The Ball Blue Book and/or Kerr Home Canning and Freezing Book were frequently used by about one-third of the subjects in each

group. The majority of subjects in both groups (≥69%) did not use cookbooks, manufacturers directions, USDA food preservation bulletins, popular press books, newspapers, magazines or radio as information sources (Table 18).

Significantly more pre/post-tested control group subjects received food preservation training from high school or college home economics courses than did Master Canners (Table 19). No significant differences were found between the groups for any other training sources. The majority of subjects (≥91%) in each group had not received previous food preservation training.

No significant difference was found between the sex of Master Canners and pre/post-tested control group subjects. Fifty-one (90%) Master Canners were female and six (10%) were male. The pre/post-tested control group had 81 (96%) females and 3 (4%) males (Table 9).

While the demographic and food preservation background differences noted between Master Canners and pre/post-tested control group subjects may account for each group's performance on the knowledge and attitude instruments used in this study, different results may have been obtained if different and/or additional counties had offered Master Canner programs in 1986. Seven of the nine participating Master Canner counties, Bay, Genesee, Kent, Macomb, St. Clair, Washtenaw and Wayne, are suburban or urban areas, whereas, Allegan and Iosco counties are less populated or in largely rural areas of Michigan. Fifty of

the 57 Master Canner program participants resided in the more urban counties suggesting that the noted demographic and food preservation background differences may have been an artifact of the small and unrepresentative sample of Master Canner counties and program recipients participating in this study. Quite different demographic and food preservation background qualities may have characterized a sample of Master Canner program participants from largely rural counties or a sample drawn from an equal number of rural and urban counties.

In summary, pre/post-tested control group subjects and controls who received post-test materials only did not differ on any demographic or food preservation background characteristics. Once similarities between these two groups were established, demographic and food preservation background comparisons were made between the pre/post-tested control group subjects and the Master Canner program recipients. It was hypothesized that these two groups differed only by the Master Canners participation in the comprehensive CES food preservation training program. Yet, statistical comparisons revealed significant demographic differences related to the occupations, ages, educational level and place of residence of subjects. The group's also differed significantly in their amount of food preservation experience, methods of food preservation previously tried and currently used, types of equipment readily available for use and their

sources of food preservation information and training. However, since baseline food preservation knowledge and attitudes were not different among study participants (see below), the investigator feels that differences in the values of the demographic variables were of little consequence.

Master Canners Motivation for Program Attendance

Master Canners responded with a variety of answers when asked, "Why did you sign up for the Master Canner program?". The most common responses were:

"to learn the proper and safe way to preserve food";

"to expand my current food preservation knowledge and learn the newest techniques and procedures";

"to learn a new skill and share my knowledge with others (4-Her's, low income families, as a Peace Corps worker, friends)";

"want to learn from an authority rather than a book and gain hands-on experience";

"so I can preserve my garden produce and have seasonal foods in the winter";

"to help save money";

"to preserve foods for the health of my family (i.e. no preservatives, no pesticides, low salt/sugar foods)";

"to learn the differences between home and commercial food processing";

"to learn to use a pressure canner with confidence";

"the program has practical application to my current job (4-H leader)".

When asked if the Master Canner program's volunteer component influenced their decision to participate in the course, positive participant responses included:

"volunteering will help reinforce what I have already learned";

"I will enjoy the experience and challenge of volunteering";

"it (volunteering) seems a fair exchange for being able to take the class";

"it will be a benefit to expand my knowledge to others (4-Her's, friends, low income families)";

"volunteer work is a good learning experience";

"volunteering will help me gain confidence in helping others";

"I enjoy sharing information with others and would have volunteered whether or not there was an expected requirement";

"it is important to tell others the value of home making and share skills".

Participants' negative responses to the program's volunteer component included:

"this (volunteering) will be a problem since I am so busy";

"I have very little time for volunteer work";

"I wanted the program material for myself and would rather not volunteer, if possible";

"I would rather pay more money and not do volunteer work";

"I don't feel that you will "force" me to volunteer if I don't have the time".

Three Master Canner participants stated they were unaware of the program's volunteer component at that time.

Food Preservation Knowledge

The mean food preservation knowledge test score for post-test only control group subjects was 17.61 (57%) out of a maximum 30 points. This score was not significantly different from the mean knowledge post-test score of 18.41 (60%) for pre/post-tested control group subjects (Table 20). Knowledge test scores for the post-test only control group ranged from 9 to 27 correct. Scores for control subjects in the pre/post-test group ranged from 11 to 28 correct.

The research design used in this study was chosen to determine if pretesting some control subjects and not others would affect the outcome of their food preservation knowledge post-test. If the pretested control subjects were sensitized to the food preservation information presented in test questions and showed marked improvement on their post-test scores, it may have been due to prior exposure to the pretest rather than the acquisition of new

Table 20. Food preservation knowledge pre- and post-test scores (mean ± standard error) for Master Canners and control group subjects.

	Group		
	Master Canners	Pre/post-tested controls	Post-test only controls
Food preservation knowledge pretest	16.85 ± .64*	17.61 ± .40	~~~~
Food preservation knowledge post-test	25.64 ± .33 **	18.41 ± .43	17.61 ± .44

* Significantly different than Master Canners post-test score ($p<.001$)
** Significantly different than pre/post-tested controls post-test score ($p<.001$)

knowledge. To determine if pretesting had a confounding effect in this study, pre/post-tested control subjects were mailed their tests six weeks apart. Since the post-test scores of the two control groups were not significantly different, these results suggest that pretesting was not a factor influencing performance on the food preservation knowledge post-test.

No significant difference was noted in the food preservation pretest scores of Master Canners and pre/post-tested control group subjects (Table 20). Mean pretest scores for Master Canners and control group subjects were 16.85 and 17.61, respectively, of a maximum 30 points. Pretest scores for Master Canners ranged from 6 to 27 correct. Control group pretest scores ranged from 9 to 27 correct. These results indicate that although the Master Canners and pre/post-tested control group subjects differed on several demographic indicators, baseline food preservation knowledge was similar between the two groups. It is possible that although control groups subjects reportedly had more years of food preservation experience than the Master Canners (Table 14), many of their food preservation practices may be outdated or not recommended by the CES. Control subjects' answers to food preservation knowledge test questions may, therefore, reflect such practices resulting in lower pretest scores for this group than might have been expected based on their previous experience.

Food preservation knowledge post-test scores were significantly higher for the Master Canners than control group subjects ($p<.001$) (Table 20). Master Canners scored an average 25.64 of 30 points on the post-test. Scores for this group ranged from 20 to 30 correct. The average post-test score in the control group was 18.41 with scores ranging from 11 to 28 correct.

From these results it appears that participation in the Master Canner program significantly improved the food preservation knowledge post-test scores of program participants. The mean test score of this group was increased by 8.79 points (52%), from a mean pretest score of 16.85 to a mean post-test score of 25.64. In contrast, no significant difference was noted between mean pre- and post-test scores of control group subjects. The mean test score was increased by less than one point (0.8, 4.5%) in this group, from 17.61 to 18.41 points, for mean pre- and post-test scores, respectively. These findings suggest that enrollment in the Master Canner program is a useful and effective way for clientele to acquire basic food preservation knowledge. Although most Master Canners entered the program with less food preservation experience than the control group subjects, it appears that the comprehensive food preservation training program provided them with the necessary background information needed to be knowledgeable of proper and safe food preservation procedures.

Many knowledge questions tested application of the subject matter taught in the course, rather than memorization of facts. For example, subjects were asked to choose the appropriate response to questions asking, "What advice would you give someone who tells you they processed 24 quarts of green beans in a boiling water bath, instead of a pressure canner, about a week ago?" and "Someone wants to know if alum should be added to pickles. What would you recommend?" Such questions were intended to be indicative of those Master Canners will likely encounter during their volunteer service. The higher post-test performance by Master Canners suggests that they were better able to apply the knowledge acquired in the course to these real life situations rather than rely on past experiences as a guide to procedures that may jeopardize a product's safety. Thus, despite the experience record of most control group subjects, it appears that many may use food preservation procedures and techniques not sanctioned by the CES.

In summary, the mean food preservation knowledge post-test scores of pre/post-tested control group subjects and post-test only controls did not differ. Similarly, no significant difference was noted in the food preservation knowledge pretest scores of Master Canners and pre/post-tested control group subjects. When food preservation knowledge post-test scores were compared between these two groups, the Master Canners showed significant improvement in their test performance.

Food Preservation Attitudes

The maximum attainable score on the three item "use of pressure canning for home preserved foods" attitude scale was 15. Scores of 12 to 15 on this scale were indicative of a subject's feeling that pressure canning was a safe and relatively easy method of food preservation that they felt confident in using. In contrast, scores of six and below indicated a subject's apprehension and unwillingness to use this method. A score of nine expressed neutrality - neither a positive nor negative feeling toward the use of pressure canning for home food preservation.

Post-test only control group subjects received a mean attitude score of 10.89 (73%) on the "use of pressure canning for home preserved foods" scale (Table 21). This was not significantly different from the mean post-test score of 11.04 (74%) obtained by control group subjects receiving both a pre- and post-test of food preservation attitudes. Scores in the post-test only control group ranged from 4 to 15. Pre/post-tested control group subjects' scores ranged from 3 to 15.

The less than one point difference (0.15) noted between control groups on this scale indicates that attitudes toward the use of pressure canning for home preserved foods were very similar. Since a score of nine represents neutrality, the average scores of 10.89 and 11.04 for post-test only and pre/post-tested control, respectively, reflect only slightly positive attitudes.

Table 21. Food preservation attitude pre- and post-test scores (mean ± standard error) on three Likert scales for Master Canners and control group subjects.

Attitude Scale		Group		
		Master Canners	Pre/post-tested controls	Post-test only controls
Nutritional value of home preserved foods	pretest	14.87 ± .45	15.27 ± .38	~~~~
	post-test	15.59 ± .53	15.82 ± .43	15.54 ± .39
Use of pressure canning for home preserved foods	pretest	11.43 ± .35 (a)	10.94 ± ,31	~~~~
	post-test	12.78 ± .23 (b)	11.04 ± .30	10.89 ± .29
Preserving foods properly and safely	pretest	29.49 ± .58 (a)	29.09 ± .57	~~~~
	post-test	32.19 ± .62 (b)	29.35 ± .56	28.36 ± .52

(a) - Significantly different from Master Canners post-test score ($p<.001$)
(b) - Significantly different from pre/post-tested control subjects post-test score ($p<.001$)

These results were not surprising. Approximately two-thirds ($\geq$61%) of the subjects in each group reported having a pressure canner available for their use (Table 17). Similarly, this was a food preservation method that had been used previously by 64% of post-test only controls and 68% of pre/post-tested control subjects (Table 15). Yet, despite equipment availability and previous experience with this method, only about half (45% of pre/post-tested controls and 50% of post-test only controls) were currently pressure canning (Table 16). It is possible that a bad experience in using a pressure canner, (i.e., steam burns, jar breakage, unsealed jars, poor food quality), had caused some subjects to form less favorable opinions toward pressure canning than they would have had previous experiences been more positive.

The maximum attainable score on the six item "nutritional value of home preserved foods" scale was 30. Scores of 24 to 30 on this scale indicated that subjects felt home preserved foods were at least equal to commercially processed foods in their nutritional value and quality. These higher scores also reflected subjects' feelings that additives and preservatives used in commercially prepared foods are useful and necessary to acheive a high quality product. In contrast, scores of 12 and below indicated a subject's feeling that home preserved foods were nutritionally superior to commercially processed foods and that the latter contained too many additives and

preservatives. A score of 18 indicated neither positive nor negative feelings toward the nutritional value of home preserved foods.

Post-test only control group subjects received a mean attitude score of 15.54 (52%) on the "nutritional value of home preserved foods" scale (Table 21). This was not significantly different from the mean post-test score of 15.82 (53%) obtained by control group subjects receiving both a pre- and post-test of food preservation attitudes. Scores in the post-test only control group ranged from 7 to 26. Pre/post-tested control subjects' scores ranged from 6 to 25.

The minimal difference (.32) between post-test scores of control subjects reflects their similarity in attitudes toward the nutritional value of home preserved foods. The somewhat low scores, however, indicate slightly negative attitudes. Since this scale is indicative of feelings that commercially processed and home processed foods are equal in quality, the results suggest that control subjects feel the latter are nutritionally superior products.

When handled and processed properly, home preserved foods can be nutritionally comparable to those commercially processed. Modern processing techniques allow for the harvest, preparation and canning, freezing or drying of foods in minimal time to assure the highest nutrient retention possible. Commercial additives and preservatives serve useful purposes such as calcium chloride added to

tomatoes as a firming agent or sulfur dioxide used to prevent discoloration of dried fruit. Home preserving conditions, however, may involve post-harvest processing delays, under- or overprocessing and/or improper or excessively long storage conditions which contribute to nutrient losses in home preserved foods. Thus, the slightly negative attitudes expressed by control subjects may be due to a lack of understanding of commercial processing techniques or the role of additives and preservatives in canned, frozen or dried products. Furthermore, it appears that control group subjects may be unaware of improper home food handling, processing or storage conditions that can effect the nutritive value of home preserved foods.

The maximum attainable score on the eight item "preserving foods properly and safely" attitude scale was 40. Scores of 32 to 40 demonstrated a subjects' positive feelings that following up-to-date food preservation recommendations were important to assure a safe product and an acceptance that procedural tasks in preserving foods often change as new research becomes available. In contrast, scores of 16 and below indicated a willingness to reject current food preservation recommendations for traditional, non-recommended and often unsafe methods, that may produce hazardous products. Lower scores also indicated a subject's misconception that the presence of a sealed canning jar or the absence of overt food spoilage

assured product safety despite the possibility of insipient spoilage. A score of 24 indicated neither agreement nor disagreement with the need for proper food preservation methods.

Post-test only control group subjects received a mean attitude score of 28.36 (71%) on the "preserving foods properly and safely" scale (Table 21). This was not significantly different from the mean post-test score of 29.35 (73%) obtained by control group subjects receiving both a pre- and post-test of food preservation attitudes. Scores in the post-test only control group ranged from 15 to 40. Pre/post-tested control subjects' scores ranged from 14 to 40.

A less than one point difference (.99) separated the attitude scores of pre/post-tested and post-test only control group subjects on this scale. The scores of 28.36 and 29.35 reflect only slightly positive attitudes toward preserving foods properly and safely. These results may be due to the previous experience record of most control group subjects. Approximately three-fourths ($\geq$74%) of the subjects in this group had been preserving foods for five years or longer (Table 14). Many food preservation recommendations, however, have been updated in the past few years to reflect newer knowledge in this area. For example, processing is now recommended for all jellied fruit products, processing times have been increased for many products and jar sterilization is recommended for

products processed 15 minutes or less (Kuhn, 1984). The low positive attitude scores noted here reflected an unawareness of updated recommendations or their rejection for more traditional "tried and true" methods that have been used successfully for years, such as open kettle canning, oven canning or water bath canning low acid foods.

No significant differences were found in the mean attitude pretest scores of Master Canners and pre/post-tested control group subjects on the "nutritional value of home preserved foods" scale. The Master Canners mean attitude score was 14.87 (50%) out of 30 (Table 21). Control group subjects had a mean attitude score of 15.27 (51%). Such scores indicate slightly negative attitudes toward the nutritional value of home preserved foods by either group. Pretest scores on the "nutritional value of home preserved foods" scale ranged from 8 to 22 for Master Canners and from 6 to 23 for control subjects. Similarly, attitudes related to the nutritional value of home preserved foods were not significantly different between Master Canners and pre/post-tested control group subjects when post-test scores were compared. Of the maximum attainable score of 30 for this scale, Master Canners and control group subjects had mean scores of 15.59 (52%) and 15.82 (52%), respectively (Table 21). Post-test scores on this scale ranged from 8 to 20 for Master Canners and from 6 to 25 for control subjects.

A high score on this scale indicates a positive attitude that the nutritional value of home preserved foods is equal to those commercially processed. The pretest scores for these groups were low, however, indicating that all subjects shared a common feeling that commercially processed products were inferior in nutritive value and quality when compared to home preserved foods.

Surprisingly, attitudes related to this scale remained unchanged in Master Canners despite their participation in the CES food preservation training program. There are several possible explanations for this noted resistance to change. First, despite the safety record of most food additives and preservatives, several have come under fire in recent years. For example, sulfites used to prevent browning reactions in fruits and light-colored vegetables have been linked to severe allergic reactions in several people (Buckley et al., 1985). Nitrates, added to preserve the color of cured meat products, can combine with protein to form nitrosamines, a suspected carcinogen (National Academy of Sciences, 1981). Sodium chloride, added as a flavoring agent to many foods and a curing agent to pickled foods, has been associated with the development of hypertension in sodium-sensitive individuals (Houston, 1986). Publicity for these issues has been widespread and public awareness is high. Consequently, Master Canners' opinions may be biased against the nutritional value of commercially processed

foods particularly if they view additive and preservative use as detrimental.

No significant differences were found in the attitude pretest scores of Master Canners and pre/post-tested control group subjects on the "use of pressure canning for home preserved foods" scale. The Master Canners mean attitude score was 11.43 (76%) out of 15 (Table 21). Control group subjects had a mean attitude score of 10.94 (73%) (Table 21). Such scores indicate a positive attitude toward the use of pressure canning for home food preservation. Pretest scores on the "use of pressure canning for home preserved foods" scale ranged from 5 to 15 for Master Canners and from 3 to 15 for control subjects.

Master Canners and pre/post-tested control group subjects differed significantly ($p<.001$) on their post-test mean attitude scores for the "use of pressure canning for home preserved foods" scale. Mean attitude post-test scores for Master Canners and control subjects were 12.78 (85%) and 11.04 (74%), respectively (Table 21). Post-test scores on this scale ranged from 8 to 15 for Master Canners and from 3 to 15 for control subjects.

These results suggest that participation in the Master Canner program favorably affected the participants' attitudes toward the use of pressure canning for home food preservation. Although half (56%) of the Master Canners reported having a pressure canner available for their use (Table 17), 75% indicated that they were not currently

using this food preservation method (Table 16). Since half (47%) of the participants had previously tried pressure canning (Table 15), it is possible that many found the process too frightening or complicated to warrant its continued use. The equipment use demonstrations and hands-on preserving experience provided in the Master Canner program may have given participants the opportunity to overcome fears or apprehensions toward pressure canner use. Since control group subjects received no formal food preservation training, their attitudes, only slightly favorable toward the use of pressure canning, remained unchanged over the six week span from pre- to post-test.

No significant differences were found in the attitude pretest scores of Master Canners and pre/post-tested control group subjects on the "preserving foods properly and safely" scale. The Master Canners mean attitude score was 29.49 (74%) out of 40 (Table 21). Control group subjects had a mean attitude score of 29.09 (73%). These scores indicate that both groups had a positive attitude toward the use of proper food preservation methods. Pretest scores on the "preserving foods properly and safely" scale ranged from 18 to 40 for Master Canners and from 11 to 40 for control group subjects.

Master Canners and pre/post-tested control group subjects differed significantly ($p<.001$) on their mean post-test attitude scores for the "preserving foods properly and safely" scale. Mean post-test attitude scores

for Master Canners and control subjects were 32.19 (80%) and 29.35 (73%), respectively (Table 21). Post-test scores on this scale ranged from 21 to 40 for Master Canners and from 14 to 40 for control subjects.

The significantly higher mean post-test attitude scores of Master Canners when compared with control group subjects on the "preserving foods properly and safely" scale suggested that the comprehensive CES food preservation program was effective in developing more positive attitudes in program participants. The noted 2.7 point increase from pre- to post-test for Master Canners indicates that participants expressed even stronger feelings at program's end toward the use of current food preservation methods that would assure product safety. Most Master Canners (73%) had had five years or less food preservation experience compared to the five or more years of most (74%) pre/post-tested control group subjects (Table 14). Since many non-recommended potentially dangerous food preservation techniques date back more than five years, it is possible that the Master Canners were less exposed and less familiar with these techniques than the control subjects. Hence, Master Canners would be less likely to reject current methods for others that have been used successfully in the past but have since been proven unsafe. Also, course material in the Master Canner program is designed to acquaint participants with rationale for current recommended methods and reasons why substitute

methods may be unsafe. For example, water bath canning, rather than a paraffin seal, is recommended for jellies to retard mold contamination. Pressure canning is required for all low acid foods to prevent botulism spore germination. With this background knowledge Master Canners may have been more likely to develop positive attitudes toward "preserving foods properly and safely" than if explanations had not been provided for recommended procedures.

In summary, the mean attitude post-test scores of pre/post-tested control group subjects and post-test only controls did not differ on any of the three attitude scales. Similarly, the mean attitude pretest scores of Master Canners and pre/post-tested control group subjects were not different for the three scales. Attitudes toward the "use of pressure canning for home preserved foods" and "preserving foods properly and safely" were significantly more positive in Master Canners than pre/post-tested control subjects when mean attitude post-test scores were compared. Master Canners post-test attitudes toward the "nutritional value of home preserved foods" remained slightly negative and unchanged from those of pre/post-tested control group subjects.

Relationships Between Variables

Kendall correlation coefficients between knowledge and attitude scores and other demographic variables at the pre-

and post-tests for Master Canners and the pre/post- tested control group subjects were determined (Table 22). When the correlation coefficients were significant, they were also low in value ($\leq .38$) indicating the relationships were weak.

Food Preservation Knowledge and Demographic Variables

No significant relationships were found between food preservation knowledge pre- or post-test scores and ages of Master Canners or control group subjects (Table 22).

The educational level of Master Canners and control group subjects was not significantly correlated with food preservation knowledge pretest scores (Table 22). A significant positive correlation was noted between food preservation knowledge post-test scores and educational level for Master Canners. The relationship between post-test scores and educational level for control group subjects, however, was not significant (Table 22).

The non significant relationships noted between food preservation knowledge, age and educational level of Master Canners and control group subjects were not unexpected. Few constraints are placed on individuals wishing to preserve their own foods. Food preservation is a hobby that can be enjoyed by most people regardless of age, sex, educational level or other factors. While initial equipment investments (i.e. freezer, dehydrator, water bath and pressure canners, jars) may be a constraint to those on

Table 22. Kendall correlation coefficients between demographic, knowledge and attitude variables for Master Canners and pre/post-tested control group subjects.

	Variables	Food preservation knowledge test		Attitude Scale: Use of pressure canning for home preserved foods		Attitude Scale: Nutritional value of home preserved foods		Attitude Scale: Preserving foods properly and safely	
		Master Canners	Controls	Master Canners	Controls	Master Canners	Controls	Master Canners	Controls
PRETEST	Age	0.01	0.08	0.03	0.09	0.11	0.09	.25 (b)	-0.08
	Educational level	0.1	0.11	0.07	0.1	0.04	0.05	0.2	0.08
	Food preservation experience	.33 (c)	.24 (b)	0.19	.19 (a)	-0.002	0.07	.32 (b)	-0.07
	Food preservation knowledge test	1	1	.19 (a)	.22 (b)	0.02	.19 (b)	.38 (b)	.21 (b)
POSTTEST	Age	0.03	0.09	-0.03	0.08	0.04	0.12	.30 (b)	0.01
	Educational level	.29 (b)	0.03	0.09	0.04	0.15	0.07	0.16	0.007
	Food preservation experience	0.08	.19 (a)	.21 (a)	.22 (b)	0.08	0.11	.23 (a)	0.04
	Food preservation knowledge test	1	1	0.04	.24 (b)	0.04	.29 (c)	.24 (b)	.21 (b)

(a) - Significant at p<.05
(b) - Significant at p<.01
(c) - Significant at p<.001

fixed or limited incomes, the equipment is intended for long-term use and other costs can be minimal.

While a significant relationship was noted between educational level and Master Canners' food preservation knowledge post-test scores, its importance is questionable. Since no statistically significant difference was found between pretest scores of Master Canners (mean pretest score = 16.85) and control group subjects (mean pretest score = 17.61) the results indicate that despite a higher level of education for most Master Canners (Table 12), years of schooling was not a factor in determining knowledge pretest outcome. It is possible that the educational background of Master Canners was useful in applying what they learned in the program to questions on the food preservation knowledge test. However, because the Master Canner program was the intervening variable between the food preservation knowledge pre- and post-tests it seems likely that program participation had more influence on knowledge post-test scores than the subjects' educational background.

Food preservation experience was significantly and positively correlated with food preservation knowledge test scores for Master Canners and control group subjects (Table 22). A similar significant positive relationship was noted between food preservation knowledge post-test scores and preserving experience for control group subjects, but not for Master Canners (Table 22).

These results indicate that food preservation experience was the most important demographic variable influencing the food preservation knowledge pretest scores of both groups. Although the correlation was low (r = .19), food preservation experience was also directly related to food preservation knowledge post-test scores of control group subjects. This result was expected since control subjects did not receive food preservation training and had only their previous knowledge and experience to aid them in answering test questions.

Master Canners food preservation experience, however, was not significantly correlated with knowledge post-test scores suggesting that participation in the comprehensive training program was a more important influence on test outcome than previous experience. Had Master Canners not received food preservation training, negligible gains in pre- to post-test knowledge scores, similar to those of control subjects, would have been expected.

Food Preservation Attitudes and Demographic Variables

Pre- and post-test scores on the "preserving foods properly and safely" attitude scale were significantly correlated with the ages of Master Canners (Table 22). No significant relationships were noted, however, between age and Master Canners' pre- or post-test attitudes toward the "use of pressure canning for home preserved foods" or the "nutritional value of home preserved foods" scales.

Attitude pre- and post-test scores for all three scales were not significantly related to the ages of control group subjects.

No significant relationships were found between educational level attained and attitude scale pretest scores for Master Canners or control group subjects (Table 22). Similarly, no significant relationships were noted between the groups when post-test scores and educational level were examined.

Master Canners food preservation experience was significantly and positively correlated with pre- and post-test attitudes toward "preserving food properly and safely" (Table 22). A significant positive correlation was also noted between food preservation experience and Master Canners post-test attitudes toward the "use of pressure canning for home preserved foods". No relationship was found between Master Canners food preservation experience and their pretest attitudes on this scale. Similarly, no significant relationships were found between Master Canners food preservation experience and pre- or post-test attitudes related to the "nutritional value of home preserved foods". Food preservation experience was significantly and positively correlated with both pre- and post-test attitudes toward the "use of pressure canning for home preserved foods" in control group subjects (Table 22). Pre- and post-test attitudes toward the "nutritional value of home preserved foods" and "preserving foods

properly and safely", however, were not related to the food preservation experience of this group.

Food Preservation Knowledge and Attitudes

Significant positive relationships were found between food preservation knowledge and attitudes toward the "use of pressure canning for home preserved foods" and "preserving foods properly and safely" when Master Canners pretest scores were compared (Table 22). Pretest attitudes on the "nutritional value of home preserved foods" scale were not significantly related to food preservation knowledge in these subjects. While post-test attitudes of Master Canners on the "preserving foods properly and safely" scale were significantly and positively correlated with food preservation knowledge, no significant relationships were noted between post-test food preservation knowledge and scores on the other two attitude scales (Table 22). Conversely, significant, positive relationships were noted among food preservation knowledge and all attitude scales when pre- and post-test scores of control group subjects were compared (Table 22).

Sims (1980) reviewed the findings of studies that examined the nutrition knowledge - attitude relationship and reported that the most prevalent relationship was a positive correlation between knowledge and attitudes. Conversely, other researchers have found no correlation between knowledge and attitudes (Petersen and Kies, 1972;

Krause and Fox, 1977; Guiry and Bisogni, 1986; Brush et al., 1986). Since the present study is concerned with food preservation, rather than nutrition, knowledge and attitudes, direct comparisons are not possible. However, generalizations can be made about the knowledge - attitude relationship patterns previously noted.

In the pretest, the Master Canners showed a positive correlation between food preservation knowledge and attitudes toward the "use of pressure canning for home preserved foods" and "preserving foods properly and safely". These results suggest that the more Master Canners knew about food preservation prior to the training program, the more willing they were to use a pressure canner and the more conscientious they were about using proper methods. A significant correlation was noted between Master Canners food preservation knowledge post-test scores and their attitudes toward "preserving foods properly and safely". Thus it appears that participation in the Master Canner program may be instrumental in promoting positive attitudes toward safe and proper preserving practices.

Although Master Canners' post-test attitudes toward the use of pressure canning were not correlated with their food preservation knowledge, post-test attitude scores indicted that Master Canners had developed more positive attitudes on this subject over the course of the training program. Hence, it appears that factors other than an

increase in food preservation knowledge may be responsible for the noted positive attitude change.

Master Canners' pre- and post-test attitudes toward the "nutritional value of home preserved foods" were not correlated with their food preservation knowledge. In addition, when pre- and post-test scores were compared, no change was noted in participants' attitudes toward this topic. Thus, the slightly negative attitudes toward the nutritional value of home preserved foods held by Master Canners were unrelated to gains in their food preservation knowledge and appear to be relatively resistant to change.

Significant relationships between food preservation knowledge and attitudes were noted at the pre- and post-tests for control group subjects on all attitude scales. It is interesting to note that attitude scale scores remained unchanged in this group between administration of the pre- and post-tests. Thus it is not surprising that the significant knowledge - attitude relationships were consistent over time in the absence of an intervening variable (i.e., the Master Canner training program) that may have had an imposing effect on the attitudes expressed by these subjects.

In summary, Kendall correlation coefficients were determined between knowledge and attitude scores and other demographic variables at the pre- and post-tests for Master Canners and the pre/post-tested control group subjects. Generally, the pre- and post-test correlations between age

and educational level and food preservation knowledge test and attitude scale scores were not significant.

Food preservation experience was positively and significantly correlated with the food preservation knowledge pretest scores for both groups. A significant correlation was also noted between food preservation experience and knowledge post-test scores for control group subjects. Master Canners food preservation experience, however, was not correlated with their scores on the food preservation knowledge post-test.

No significant relationships were found between food preservation experence and pre- or post-test attitudes toward the "nutritional value of home preserved foods" for the Master Canners or control group subjects. Pre- and post-test attitudes toward "preserving foods properly and safely" were positively and significantly correlated with the food preservation experience of Master Canners but not control group subjects. Food preservation experience was significantly correlated with pretest attitudes toward the "use of pressure canning for home preserved foods" in control group subjects only. Post-test attitudes for this scale were significantly correlated with the food preservation experience of both groups.

Significant correlations were found between food preservation knowledge pretest scores and pretest attitudes toward the "use of pressure canning for home preserved foods" and "preserving foods properly and safely" in Master

Canners and control group subjects. Knowledge pretest scores were correlated with pretest attitudes toward the "nutritional value of home preserved foods" in control group subjects only. Control subjects post-test attitudes for all three scales were positively and significantly correlated with their food preservation knowledge post-test scores. Master Canners knowledge post-test scores were correlated with post-test attitudes toward "preserving foods properly and safely" only.

Generally, when correlations were significant they were also low in value indicating that relationships between variables were not strong.

Implications and Recommendations

Since its development in 1980, the CES Master Canner program has not undergone a formal evaluation. Over the last seven years, the program has trained hundreds of volunteers to assist EHEs with client food preservation questions and programs. Yet, a preliminary survey of EHEs, conducted in 1986 by the investigator, revealed that EHEs perceived that many Master Canners may lack the knowledge necessary to respond to critical food safety issues despite their training. Hence, this study was designed to assess the food preservation knowledge and attitudes of subjects enrolled in Master Canner programs throughout Michigan during 1987. Three Likert scales designed to assess attitudes toward the "nutritional value of home preserved foods", the "use of pressure canning for home preserved foods" and "preserving foods properly and safely" and a 30 item food preservation knowledge test, developed specifically for this study, were used.

Established methods of knowledge test and attitude scale construction were used with appropriate steps taken to insure the instruments were valid and reliable. Prior to this research, successful completion of the Master Canner program was contingent upon passage of a 20 question short answer final exam. Validity and reliability of this test were not established. No attempt was made to assess attitudes of program participants. Thus the food

preservation knowledge test developed for this research could be a useful evaluation tool to certify competency of future Master Canner program participants. Since knowledge test questions were representative of the subject matter Master Canners are expected to have upon completion of the program, it is suggested that the test be adopted for statewide use. Relatively simple hand or computer-aided calculations, based on participant pre- and post-test scores, would provide EHEs with data to certify program graduates and to support continuation of the program.

The attitude scales used in this research detected attitudinal changes among Master Canners toward the "use of pressure canning for home preserved foods" and "preserving foods properly and safely." Attitudes toward the "nutritional value of home preserved foods" remained unchanged in Master Canners from pre- to post-test, however, the investigator made no attempt to promote more positive attitudes among program participants during the study. Use of the attitude scales employed in this research for future Master Canner programs would provide EHEs with useful information for planning educational strategies to promote positive food preservation attitudes among program recipients.

With the small number of Master Canner counties participating in this study, it is suggested that the research be repeated another year to improve the generalizability of the results. Efforts should be focused

on increasing the number of Master Canner counties and obtaining a sample representative of the state's rural and urban population. If the results reported in this research are confirmed by additional testing they will serve to reinforce the role of the CES as a credible source of food preservation information and training. Volunteers could be used to recruit potential program participants. Research results could be used to demonstrate program effectiveness if federal funds are requested to support program costs.

The pre/post-test design used in this study is a useful prototype for future CES program evaluations. Many CES programs are presented as a series of lessons or workshops with sufficient time passage from beginning to end to assess pre- to post-test knowledge and/or attitude changes. The procedures used to develop and validate the food preservation knowledge and attitude instruments can easily be adapted to other subject matter areas.

Research Strengths and Limitations

Strengths

With the CES engulfed in strict budgetary constraints it is imperative that existing funds be used to support programs with demonstrated effectiveness. This study objectively demonstrates for the first time that the CES Master Canner program is effective in improving food preservation knowledge and promoting positive food preservation attitudes among recipients. The study reported herein was well designed with appropriate steps taken to control for variables which may have threatened the internal and external validity of results. Instruments developed to assess food preservation knowledge and attitudes were valid and reliable. Appropriate statistical tests were used to analyze the data. This study was also effective in reaching a broad cross-section of CES clientele of differing ages and socioeconomic backgrounds from both urban and rural areas of the state.

Limitations

Sample size was a major limiting factor in this study. Of the 83 counties in Michigan, only nine conducted Master Canner programs during 1986, with a total of 57 study participants. While the investigator aggressively sought the help of EHEs to conduct Master Canner programs, circumstances beyond her control (local client interest in

the program, time availability of the EHE, availability of monetary resources to cover program costs, county program priorities, availability of an appropriate time and place to conduct program sessions, the need for Master Canner volunteer help in a county, etc.) prevented many from participating in this research. In addition, seven of the nine Master Canner counties included in this study were primarily suburban or urban areas. A larger sample size comprised of participants from an equal number of rural and urban counties is needed to make a study such as this truly representative of the state's sample population. The investigator feels it is unlikely, however, that a county sample size of greater than 20 to 25 is possible based on reasons stated above and the length of time the Master Canner program has already been in effect in Michigan.

A second limitation of this study was the absence of a post-test only group of Master Canner subjects. The modified Solomon Four Group Design used in this study called for control subjects to be divided into two groups: (1) pre- and post-test and (2) post-test only. Due to the small sample size of Master Canners, however, all were asked to complete the pre- and post-program food preservation knowledge test and attitude questionnaire. Knowledge and attitude scores resulting from the split design used with control subjects suggested that pretesting was not a factor influencing their post-test performance. A pretest effect cannot be ruled out entirely for Master

Canners, however, since the limited sample size precluded the use of a pre/post-test and post-test only group design.

A follow up study to this reseach should include a behavioral assessment of Master Canners during their volunteer service. Behavioral assessment was not possible in this study since the structure of the Master Canner program focuses on lectures/demonstrations and hands-on experiences to teach Master Canners the food preservation background information they will need to successfully complete their volunteer service. While this study demonstrated that participation in the Master Canner program significantly improved food preservation knowledge and promoted positive food preservation attitudes among recipients, it remains unclear whether these gains will be applied during their volunteer service.

CONCLUSIONS

The food preservation knowledge and attitudes of 57 participants enrolled in nine CES Master Canner programs were assessed. Three Likert scales designed to measure attitudes toward the "nutritional value of home preserved foods", the "use of pressure canning for home preserved foods" and "preserving foods properly and safely" and a 30 item food preservation knowledge test were developed for use in a pre- and post-test format. Eighty-four control subjects received the same pre- and post-tests with no intervening food preservation training program. Ninety-seven additional control subjects received post-test only materials to determine whether pretesting biased post-test results in some control subjects. Post-test scores of the two control groups were not significantly different. Likewise, pretesting revealed no significant knowledge or attitude differences between the Master Canners and pre/post-tested control subjects. Comparisons were then made between Master Canners and control group subjects' post-test scores to determine the effectiveness of the program. Food preservation knowledge post-test scores were significantly higher for the Master Canners

than control group subjects. Master Canners post-test attitudes toward the "use of pressure canning for home preserved foods" and "preserving foods properly and safely" were significantly more positive than those of control subjects. Master Canners post-test attitudes toward the "nutritional value of home preserved foods" remained slightly negative and unchanged from those of control group subjects. These findings suggest that enrollment in the Master Canner program is a useful and effective way for clientele to acquire basic home food preservation knowledge. The program was successful in instilling more positive attitudes in participants on two of the three attitude dimensions measured. Futhermore, the sample participating in this research indicates that the CES is reaching a broad range of clientele, with differing socioeconomic backgrounds, in both rural and urban areas of Michigan.

APPENDICES

APPENDIX A

UCRIHS APPROVAL FORM

APPENDIX A

UCRIHS APPROVAL FORM

MICHIGAN STATE UNIVERSITY

UNIVERSITY COMMITTEE ON RESEARCH INVOLVING HUMAN SUBJECTS (UCRIHS)
230 ADMINISTRATION BUILDING
(517) 355-2186

EAST LANSING • MICHIGAN • 48824-1046

December 3, 1985

Ms. Penny Ross
Food Science & Human Nutrition
204 Food Science Building

Dear Ms. Ross:

Subject: Proposal Entitled, "The Impact of the Master Canner Program on Food Preservation Knowledge and Attitudes"

UCRIHS review of the above referenced project has now been completed. I am pleased to advise that the rights and welfare of the human subjects appear to be adequately protected and the Committee, therefore, approved this project at its meeting on December 2, 1985.

You are reminded that UCRIHS approval is valid for one calendar year. If you plan to continue this project beyond one year, please make provisions for obtaining appropriate UCRIHS approval prior to December 2, 1986.

Any changes in procedures involving human subjects must be reviewed by the UCRIHS prior to initiation of the change. UCRIHS must also be notified promptly of any problems (unexpected side effects, complaints, etc.) involving human subjects during the course of the work.

Thank you for bringing this project to our attention. If we can be of any future help, please do not hesitate to let us know.

Sincerely,

Henry E. Bredeck
Chairman, UCRIHS

HEB/jms

cc: Dr. Jenny T. Bond

APPENDIX B

PARTICIPANT CONSENT FORM

APPENDIX B

PARTICIPANT CONSENT FORM

COOPERATIVE EXTENSION SERVICE
Michigan State University

Department of Food Science and Human Nutrition

165 South Anthony Hall
East Lansing, Michigan 48824 1225

CONSENT FORM

I, _____, agree to participate in the food preservation research study which is being conducted by Penny Ross of the Michigan State University Cooperative Extension Service. The purpose of the study has been explained to me and I have been given the opportunity to ask questions.

As a participant in this study I understand I will be asked to take a written test and complete a questionnaire related to my knowledge of and attitude toward food preservation. I will also be asked questions about my personal background and whether or not I routinely preserve my own food at home.

I understand that my participation in the study does not guarantee any beneficial results to me. I am free to discontinue my participation in the study at any time, and such action will have no influence on services I receive from the Cooperative Extension Service. I also may decline to answer any questions I find unacceptable. I understand that my responses and all information about me will be treated in strict confidence and that I will remain anonymous. General results of the formal study, entitled "The Impact of the Master Canner Program on Food Preservation Knowledge and Attitudes", will be made available to me at my request.

Signed_____

Date _____

APPENDIX C

CLIENT TELEPHONE INFORMATION FORM

APPENDIX C

CLIENT TELEPHONE INFORMATION FORM

MASTER CANNER RESEARCH STUDY

Client Information Log

Client Name: _____ **Date:** _____

Address: _____
street

_____ MI _____
city state zip code county

Telephone: ___(_____)_____
area code

Nature of Question: _____

_____

PR 4/85

APPENDIX D

SUPPLEMENTAL INFORMATION QUESTIONNAIRE

APPENDIX D

Code _____

SUPPLEMENTAL INFORMATION

1. What is your sex? (CIRCLE THE APPROPRIATE LETTER)

a) Female
b) Male

2. What is your occupation? _____ (WRITE IN)

3. What is your age? (CIRCLE THE APPROPRIATE LETTER)

a) Less than 25
b) 25 - 34
c) 35 - 44
d) 45 - 54
e) 55 - 64
f) 65 or over

4. What is the highest level of education you have completed? (CIRCLE THE APPROPRIATE LETTER)

a) 8th grade or less
b) Some high school
c) High school graduate
d) Some college
e) College graduate
f) Some post-graduate work
g) An advanced college degree (i.e. M.S., Ph.D., M.D., etc.)

5. Concerning where you live, is it a: (CIRCLE THE APPROPRIATE LETTER)

a) Farm
b) Rural area
c) Small town (less than 50,000 people)
d) Suburban area
e) Large city (50,000 or more people)

6. What method(s) of food preservation have you tried? (CIRCLE THE APPROPRIATE LETTER)

a) Freezing
b) Water bath canning
c) Pressure canning
d) Pickle making
e) Drying
f) Jam or jelly making
g) No previous experience with preserving foods

7. How much experience do you have in preserving food (i.e. canning, freezing, drying, pickling, etc.) at home? (CIRCLE THE APPROPRIATE LETTER)

a) No previous experience
b) Less than 6 months
c) 6 months - 1 year
d) 1 - 5 years
e) 5 - 10 years
f) More than 10 years

8. What method(s) of food preservation do you use most frequently now? (CIRCLE THE APPROPRIATE LETTER)

a) Freezing
b) Water bath canning
c) Pressure canning
d) Pickle making
e) Drying
f) Jam or jelly making
g) Not currently preserving food

9. What type(s) of food preservation equipment do you have readily available for your use? (CIRCLE THE APPROPRIATE LETTER)

a) Water bath canner
b) Pressure canner
c) Freezer
d) Dehydrator (commercial or homemade)
e) None

10. To what extent do you use the following sources for food preservation information: (CHECK THE APPROPRIATE COLUMN)

	Always	Sometimes	Not at all
a) Immediate family member	____	____	____
b) Relative	____	____	____
c) Neighbor/friend	____	____	____
d) Food preparation and/or preservation course	____	____	____
e) Cooperative Extension Service	____	____	____
f) Reference book(s) - please list those used:			
_____			
_____	____	____	____
g) Other sources: _____			
_____	____	____	____

11. Have you been in a course or received food preservation training from any of the following: (INDICATE Y FOR YES, N FOR NO)

a) _____ Adult education class
b) _____ High school or college home economics course
c) _____ 4-H foods and nutrition program
d) _____ Other _____

12. Why did you sign up for the Master Canner program?

_____

_____

_____

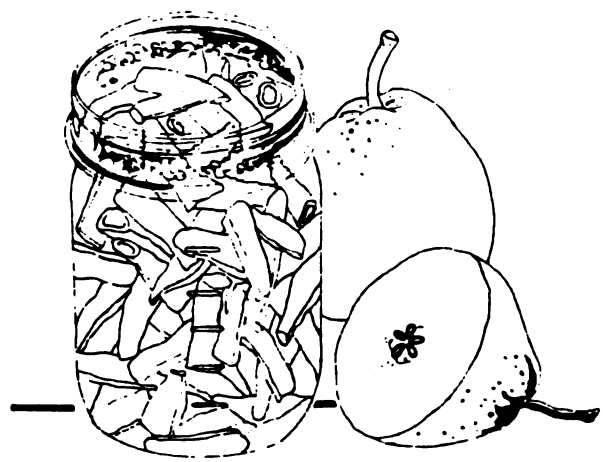
13. Part of the requirement for the Master Canner course is 10 hours of volunteer service. Did this volunteer component influence your decision to participate in the program?

Yes No (CIRCLE ONE)

Please explain _____

_____

_____



APPENDIX E

TAXONOMY OF EDUCATIONAL OBJECTIVES: COGNITIVE DOMAIN

APPENDIX E

TAXONOMY OF EDUCATIONAL OBJECTIVES: COGNITIVE DOMAIN

Knowledge

1.00 KNOWLEDGE (Remembering previously learned material)
- 1.10 Knowledge of specifics
- 1.11 Knowledge of terms
- 1.12 Knowledge of specific facts
- 1.20 Knowledge of ways and means of dealing with specifics
  - 1.21 Knowledge of conventions
  - 1.22 Knowledge of trends and sequences
  - 1.23 Knowledge of classifications and categories
  - 1.24 Knowledge of criteria
  - 1.25 Knowledge of methodology
- 1.30 Knowledge of the universals and abstractions in a field
  - 1.31 Knowledge of principles and generalizations
  - 1.32 Knowledge of theories and structures

Intellectual Abilities and Skills

2.00 COMPREHENSION (Grasping the meaning of material)
- 2.10 Translation (Converting from one form to another)
- 2.20 Interpretation (Explaining or summarizing material)
- 2.30 Extrapolation (Extending the meaning beyond the data)

3.00 APPLICATION (Using information in concrete situations)

4.00 ANALYSIS (Breaking down material into its parts)
- 4.10 Analysis of elements
- 4.20 Analysis of relationships
- 4.30 Analysis of organizational principles

5.00 SYNTHESIS (Putting parts together into a whole)
- 5.10 Production of a unique communication
- 5.20 Production of a plan or proposed set of operations
- 5.30 Derivation of a set of abstract relations

6.00 EVALUATION (Judging the value of a thing for a given purpose using definite criteria)
- 6.10 Judgements in terms of internal evidence
- 6.20 Judgements in terms of external criteria

Reference: Bloom, B., M. Engelhart, E. Furst, W. Hill and D. Krathwohl. Taxonomy of Educational Objectives: Cognitive Domain. New York, NY: David McKay Co., Inc., 1956, pp. 201-207.

APPENDIX F

EDWARDS' INFORMAL CRITERIA FOR ATTITUDE STATEMENT CONSTRUCTION

APPENDIX F

EDWARDS' INFORMAL CRITERIA FOR ATTITUDE STATEMENT CONSTRUCTION

1. Avoid statements that refer to the past rather than the present.

2. Avoid statements that are factual or capable of being interpreted as factual.

3. Avoid statements that may be interpreted in more than one way.

4. Avoid statements that are irrelevant to the psychological object under consideration.

5. Avoid statements that are likely to be endorsed by almost everyone or by almost no one.

6. Select statements that are believed to cover the entire range of the affective scale of interest.

7. Keep the language of the statements simple, clear and direct.

8. Statements should be short, rarely exceeding 20 words.

9. Each statement should contain only one complete thought.

10. Statements containing universals such as all, always, none and never introduce ambiguity and should be avoided.

11. Words such as only, just, merely, and other of a similar nature should be used with care and moderation in writing statements.

12. Whenever possible, statements should be in the form of simple sentences rather than in the form of compound or complex sentences.

13. Avoid the use of words that may not be understood by those who are to be given the completed scale.

14. Avoid the use of double negatives.

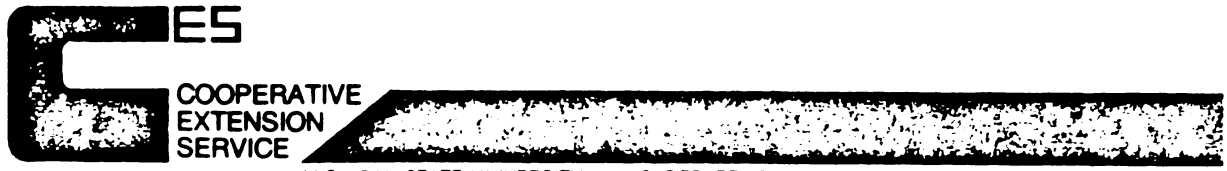
Reference: Edwards, A. Techniques of Attitude Scale Construction. New York, NY: Appleton-Century-Crofts, Inc., 1957, pp. 13-14.

APPENDIX G

LETTER SENT TO PROFESSIONAL REVIEW COMMITTEE MEMBERS

APPENDIX G

LETTER SENT TO PROFESSIONAL REVIEW COMMITTEE MEMBERS



MICHIGAN STATE UNIVERSITY • U.S. DEPARTMENT OF AGRICULTURE & COUNTIES COOPERATING
FOOD SCIENCE & HUMAN NUTRITION • 165 ANTHONY HALL • EAST LANSING • MICHIGAN 48824-1225

October 8, 1985

Milton P. Baldauf
Assistant Deputy Administrator
Home Economics and Human Nutrition
USDA Extension Service
Washington, D.C. 20250

Dear Dr. Baldauf:

Your help is needed. A research study has been designed to determine the food preservation knowledge and attitudes of participants enrolled in the Michigan Cooperative Extension Service Master Canner program. The Master Canner program is designed to train volunteers to assist Extension Home Economists with consumer food preservation questions and programs. You are one of several experts being asked to review the evaluation instruments which have been developed for this study.

Since providing accurate food preservation information to clientele may mean the difference between a safe food and a hazardous one, Master Canners must have thorough knowledge of the background information covered in the training program. Also, since attitudes may play an influential role in determining how information is accepted and applied, it is important to evaluate whether Master Canners possess favorable attitudes toward the use of proper food preservation procedures and are willing to follow current Extension recommendations. To assess whether our training program adequately prepares participants for their volunteer service, I have designed a food preservation knowledge test and attitude instrument. The instruments will be administered to Master Canner participants prior to and upon completion of the six week program. Your expertise is needed to review these instruments for **content** and **appropriateness** for the intended audience.

The final knowledge test will contain 30 questions - 5 for each food preservation area: drying, freezing, jelly making and pickling. The canning section will contain 10 questions. For simplicity each section of the test is on a separate page. Please review and comment on each question as necessary. Since 25 questions will need to be eliminated for preparation of the final test, please rank the questions within each area as you see their importance. The top five questions you choose for the final test should represent the basic knowledge expected of volunteers who will be providing information to clientele.

Attitude statements should be evaluated on a similar basis. Please indicate any which you feel are not representative or appropriate for this audience based on your experiences with clientele. Also, please comment on any which

you feel are inappropriately stated for use as attitude statements. An attitude scale has been provided in which to indicate responses. The items are intended to represent an array of attitudes held by participants that may reflect upon their performance in the Master Canner program. Please mark those responses which you feel would indicate the respondent holds a positive attitude toward food preservation. A detailed example for evaluating the attitude statements is provided on the cover sheet corresponding to that instrument.

The instruments will be pilot-tested in early December. To complete revisions and incorporate any suggestions you may have, I would appreciate receiving your comments by **November 6, 1985.** Should the revisions be extensive I would ask that you also review the final draft of instruments before they are pilot-tested.

Thank you for your assistance with this project. A copy of the final instruments and a summary of results will be available at your request upon completion of the study. If you have questions about the review process, I can be reached at (517) 355-7686.

Sincerely,

Penny Ross

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PKR/ljh

Enclosure

APPENDIX H

FOOD PRESERVATION KNOWLEDGE TEST

APPENDIX H

Code _____

FOOD PRESERVATION TEST

Directions:

Read each question carefully. CIRCLE the letter which corresponds to the best answer for each question. Please answer all questions. If you are unsure of an answer, mark the letter which you think is most correct.

1. You've just opened a jar of jam and noticed a small spot of mold on top. You should:

a) stir the mold into the jam until it is no longer visible
b) remove the mold and reprocess the jam
c) scrape off the mold and 1/2 inch of the jam underneath
d) throw the jam away since it is spoiled

2. Pressure canning is necessary for processing low acid foods like:

a) fruits and tomatoes
b) sauerkraut and chutneys
c) fruits and vegetables
d) vegetables and meats

3. The appropriate temperature for long term freezer storage is:

a) 32°F
b) 15°F
c) 10°F
d) 0°F

4. The source of acid in brined pickles is:

a) vinegar
b) bacterial fermentation
c) ascorbic acid
d) lime

5. The main reason for venting a pressure canner is to:

a) remove all air pockets inside the canner
b) make sure the water in the canner is boiling
c) check the gasket for leaks
d) know when to start counting processing time

6. When drying most vegetables, they should be pretreated by:

a) brine soaking
b) blanching
c) sulfuring
d) sulfiting

7. The recommended way to seal jams, jellies and preserves is by:

a) pouring the hot product into a hot jar and putting on the lid
b) inverting the jar to sterilize the lid
c) topping the surface with melted paraffin
d) water bath canning

8. Pressure canning prevents botulism by:

a) forming a vacuum in the jar so botulism spores cannot grow
b) destroying botulism spores so they cannot produce toxin
c) sealing the jars so botulism spores cannot enter
d) destroying nutrients used as food by botulism spores

9. The enzymes that cause ripening changes in vegetables are destroyed by:

a) blanching
b) freezing
c) ascorbic acid
d) evaporation of moisture

10. Which type of processing method should be used to produce the crispest pickles?

a) pressure canning at 5 pounds pressure
b) simmering water bath canning (180-185°F)
c) oven canning
d) steam canning

11. What advice would you give someone who tells you they processed 24 quarts of green beans in a boiling water bath, instead of a pressure canner, about a week ago?

a) throw the beans away without tasting them
b) reprocess the beans immediately in a pressure canner
c) don't eat the beans without first boiling them for 10 minutes
d) be sure and check for signs of spoilage when you open the jars

12. The proper temperature for oven or dehydrator drying of most foods is between:

a) 140° - 150°F
b) 200° - 220°F
c) 250° - 300°F
d) 325° - 350°F

13. In order to set properly, a jam or jelly must have the correct amounts of sugar, fruit, pectin and:

a) corn syrup
b) gelatin
c) water
d) acid

14. You've just discovered 2 jars did not seal from the batch of carrots you canned this morning. You should:

a) push the lids down and tighten the screw bands to seal the jars
b) recan the carrots and reprocess in a pressure canner
c) discard the carrots and use only those jars that sealed
d) heat the carrots to boiling and repack in hot, sterilized jars before sealing

15. A neighbor tells you he forgot to blanch the vegetables he froze several months ago and wants to know if they are safe to use. You tell him unblanched vegetables:

a) can contain botulism toxin and should be discarded
b) are safe to eat but their quality may be poor
c) require boiling for 10 minutes to destroy bacteria before they are consumed
d) are safe only when used in dishes that are baked at least 30 minutes

16. A distressed friend wants your opinion on a pickle problem. She carefully followed the recipe but her dill pickles still spoiled. A likely reason might be:

a) she used slicing, rather than pickling cucumbers
b) the pickles were wedged too tightly in the jar
c) hard water was used to make the pickling solution
d) the jars were improperly pretreated

17. Immediately after removing jars from the canner you should:

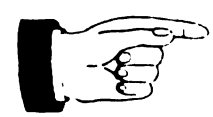
a) screw the bands down hand tight
b) test for a seal by pressing the dome lid down
c) allow the jars to cool undisturbed
d) check for proper headspace and add liquid if needed

18. The most effective pretreatment to keep fruits from turning dark during drying is:

a) ascorbic acid
b) blanching
c) vinegar-salt soak
d) sulfuring

19. Liquid and dry pectins are not interchangeable in a recipe because:

a) they are added at different times during the cooking process
b) one requires boiling and one does not
c) the type of fruit used determines the type of pectin needed
d) they require different amounts of water



20. You've just opened a jar of home canned tomatoes and noticed a small mold spot on the surface. You should:

a) remove the mold and boil the tomatoes for 10 minutes before eating
b) discard the tomatoes and the tomato liquid
c) remove the mold and tomato liquid before eating the tomatoes
d) discard the top one third portion of the tomatoes before using

21. Begin to count blanching time for vegetables as soon as they:

a) are placed in the pot and the water returns to a boil
b) have been lowered into the boiling water
c) become crisp-tender from cooking
d) are wilted or translucent

22. When making sauerkraut it is important that:

a) the cabbage be checked daily for surface scum
b) white vinegar be used to prevent discoloration
c) the cabbage be exposed to air during fermentation
d) the salt is iodized to inhibit mold growth

23. When celery, onion and green pepper are added to home canned tomatoes, which processing method should be used?

a) steam canning
b) pressure canning
c) water bath canning
d) open kettle canning

24. Properly dried fruits will be:

a) leathery and pliable
b) crisp and brittle
c) sticky and shriveled
d) cracked and hard

25. Jams and jellies sweetened with artificial sweeteners:

a) use less water in the recipe so the heat processing time is longer
b) require special types of pectins so the product will set properly
c) need to have fruit juice added to produce the proper consistency
d) require the addition of lemon juice to prevent mold growth

26. When using a water bath canner you start to count processing time when:

a) the jars are first placed in the boiling water
b) the water in the canner comes to a rolling boil
c) bubbles rise to the water surface
d) the jars form a vacuum seal

27. Your freezer has been off for 24 hours due to a power failure and now you're wondering if the food inside is safe to eat. All of the following are safe food handling practices EXCEPT:

a) repackaging thawed foods in moisture-vapor resistant wrap
b) checking for color or odor changes that may indicate food spoilage
c) refreezing those foods that still contain ice crystals
d) adding dry ice to the freezer to keep the temperature down

28. Someone wants to know if alum should be added to pickles. What would you recommend?

a) don't use alum since it is not needed when good quality ingredients are used
b) add alum because it brings out the flavor in pickles when it is added to the brine
c) use plenty of alum since it controls the growth of spoilage microorganisms
d) only use alum in brined pickles since it promotes fermentation

29. When placing the screwband on a jar that is ready for processing you should:

a) use a hand wrench to get as tight a seal as possible
b) screw the band down with your hand until it is on firmly
c) apply the band loosely so air can freely escape from the jar during processing
d) put the band on loosely before processing and tighten when jars are removed from the canner

30. A suitable container for storing dried foods might be:

a) canning jars with lids
b) fold top sandwich bags
c) paper bags
d) shoe boxes

Preserve Now, Eat Later

APPENDIX I

FOOD PRESERVATION ATTITUDE QUESTIONNAIRE

APPENDIX I

Code _____

FOOD PRESERVATION ATTITUDE QUESTIONNAIRE

YOUR OPINION PLEASE!

Directions:

This section of the questionnaire deals with feelings and concerns you may have about preserving foods at home. Please place a check (✓) in the one box for each item that best expresses your feelings.

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
1. I know I used the right procedures when all my canning jars seal.					
2. I am afraid to use a pressure canner.					
3. Commercially canned foods are less nutritious than home canned foods.					
4. I can always tell when a home preserved food is spoiled by the way it looks.					
5. Commercial food processing removes most of the nutrients from foods.					
6. As long as my home canned foods have unbroken seals, I know they are safe to use.					
7. Home preserved foods are better for you because they don't have a lot of additives/preservatives.					
8. When my traditional food preservation methods work it seems unnecessary to make changes based on updated recommendations by the Cooperative Extension Service.					
9. I get a better quality product when I preserve foods at home.					

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
10. I've used some of the same food preservation methods successfully for years so why change when new recommendations are made.					
11. I worry that commercially processed foods have too many additives/preservatives.					
12. Using a pressure canner is dangerous.					
13. I think traditional food preservation methods are the best because no one I know has ever died from home preserved foods.					
14. Commercially frozen foods are less nutritious than home frozen foods.					
15. I can always tell when a home preserved food is spoiled by the way it smells.					
16. Pressure canning is too complicated.					
17. My present food preservation techniques work well so there is no need to make changes.					

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