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Title: AN EVALUATION OF TWO SANITARY FOOD SERVICE MANUALS IN EDUCATING OREGON STATE UNIVERSITY FOOD SERVICE WORKERS

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A study was made by comparing two manuals and determining their effectiveness in teaching the principles of food sanitation to food service workers at Oregon State University.

Sixty food service workers on the Oregon State University campus were selected at random and divided into two groups of thirty each for the study. Each group was tested for food sanitation knowledge then given a food sanitation manual to study for one week at which time they were retested.

Two similar food sanitation manuals were used with each group using one of the two.

Two equivalent multiple-choice tests, judged valid and reliable were used Each of the two groups was given one of the two tests on the pre-test. The tests were interchanged between groups during post-testing.

It was found that both of the manuals used are effective in educating food service workers at Oregon State University and that one manual has a significant advantage in educating workers in personal hygiene. Job classification and years of education were found to be non-significant in influencing workers gain in food sanitation knowledge. It was also found that age, experience and prior training have a definite influence on the amount learned by the group studied. Older workers learned less for any level of experience or prior training. The experienced workers learned more for any level of age or prior training. Trained workers scored high on the pretesting and thus learned less for any level of experience and age.

AN EVALUATION OF TWO SANITARY FOOD SERVICE MANUALS IN EDUCATING OREGON STATE UNIVERSITY FOOD SERVICE WORKERS

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CHAPTER I

Introduction

A vital factor in food sanitation is the training of personnel. According to Longree and Blaker, the money, time and effort that go into a sanitation program are wasted if the people working in food service are not aware of, or knowledgeable about, appropriate sanitary practices (17, p. 193).

With today's trend toward industrial catering and centralized food preparation, food is prepared in a single, centrally located kitchen for an industrial plant, school or commercial establishment. It becomes apparent that a momentary breakdown in equipment or lack of application of food protection principles can result in illness to many individuals.

In order to achieve a high measure of disease control, much reliance has been placed on regulatory action. The United States Public Health Service Food Sanitation Manual states that: to enforce the regulations recommended . . at least once every six months, the health authority shall inspect each food establishment . . . and shall make as many additional inspections and re-inspections as are necessary for the enforcement of this ordinance (41, p. 75). However,

enforcement of a sanitary code is but one phase of a program of good sanitation: education tends to negate this need.

A food handler taught to understand the rationale of these regulations is one step away from being induced into recognizing the responsibility to protect the public. Sanitation conscious food workers are developed through good leadership, the proper tools to do the job, and followup training to develop safe food handling habits. Longree and Blaker feel that desirable work habits result from practice of correct procedures (17). Before a new employee can start practicing, a clear mental picture of what he is trying to accomplish and why it is important is essential. Thus, proper instruction and training is as important or more important than regulatory action in a food sanitation program.

Statement of the Problem

The purpose of this study is twofold: (1) to determine if food sanitation manuals are effective in educating Oregon State University food service workers and (b) to compare the effectiveness of two manuals.

Significance of the Problem

Each year food borne disease afflicts thousands of people. Public health sources believe that the actual number of cases that occur may be ten to twenty times greater than that reported (34). According to the National Communicable Disease Center, 371 outbreaks of food poisoning affected 28,563 individuals in 40 states in 1969 (37).

Though not usually of a crippling or fatal nature, such disease nonetheless causes a terrific cost in lost man hours, human suffering, and medical bills.

Even though food regulations are enforced, many foods are contaminated with food poisoning organisms before entering a food establishment. This same food may become further contaminated by improper storage or preparation prior to being served. Both of these factors are potentially dangerous; but, by themselves are rarely responsible for food borne illness. However, allow this contaminated food to remain at or near room temperature for extended periods of time and an explosive situation will develop.

The education of food handlers is attended by various other problems. Food service personnel are generally not stably situated since wages are low and conditions of work are often undesirable. The National Restaurant Association indicates that labor turnover for 1969 was 10.4 percent, nearly three times the 4.3 percent experienced by

manufacturing (20). It is difficult under these conditions to evoke a sense of responsibility from the worker in regard to his work.

Labor shortages are increasing. Nearly 39 billion meals are served yearly by more than 3.4 million workers. Estimates are that an additional 250,000 workers will be needed in the 1970's. A recent survey by the National Restaurant Association reported 82 percent of respondents experiencing employee shortages (20). These shortages of personnel are necessitating recruitment from a group that has little or no knowledge of sanitation and methods of disease transmission.

Finally, health authorities in many localities do not have sufficient staff to conduct needed training; and the food service industry itself often lacks qualified teachers, or if they are available they are usually so busy that they do not have the time nor inclination to shoulder more responsibility.

Hypotheses

The following were formulated for investigation:

1. There will be a significant gain in knowledge by food service workers due to the use of the manuals.

2. There will be a significant difference in the amount of knowledge gained by food service workers who use Manual A as compared to workers who use Manual B.
3. There will be a significant gain in knowledge by food service workers in each category of the test: (a) food protection, (b) personal hygiene, and (c) establishment and equipment sanitation, due to the use of the manuals.
4. There will be a significant difference in the amount of knowledge gained in each category of the test: (a) food protection, (b) personal hygiene, (c) establishment and equipment sanitation, by food service workers who use Manual A as compared to workers who use Manual B.

Limitations of the Study

The total population of this study is limited to food service workers at Oregon State University. A representative population was assumed, and no effort was made to select individual representative workers. Other limitations are:

1. No attempt was made to motivate the food service workers to read and study the food sanitation manual beyond the initial orientation.

2. The population was not screened as to prior food handler instruction, sex, job classification, age or their ability to read.
3. No attempt was made to determine if employee performance of foodhandling techniques were improved as a result of reading the manual.
4. The outcomes of this study are limited by whether or not the sample is truly representative.
5. Only one week was allowed to read and study the manual between pre and post testing.

Definition of Terms

The following terms are defined as they were used in the study:

Evaluation: The process of determining the value or worth of food sanitation manuals in educating food service workers.

Food Sanitation: The use of sanitary procedures by food service workers to prevent transmission of disease through food.

Food Sanitation Manual: A guide designed to provide the food service worker with information about basic principles of food sanitation.

Manual A: A food sanitation manual entitled "Sanitary Food Service Manual", prepared by the author (Appendix A).

Manual B: A food sanitation manual entitled "Food Service Workers' Manual", prepared by Oliver H. Johnson, Sanitarian, Washington State (Appendix B).

OSU: An abbreviation of Oregon State University.

Random Sample: A sample in which each and every food service worker at Oregon State University had an equal chance of being drawn into the sample.

CHAPTER II

Review of Literature

Research in teaching methodology is voluminous. Studies are many and varied and originate as early as the turn of this century. Many of them have common treatments, data analysis and results. However, one aspect in research of teaching methodology remains apparent to this day; that is, complete agreement on the best way to present material does not exist. According to Young, there are as many proponents of one method as there are of other methods (46, p. 68). Some tout the lecture or discussion, others the use of audio-visual techniques including pictures, films and television.

All of these techniques are useful and effective in food handlers instruction. However, a search for literature related to this study was not very fruitful. The author could find no studies bearing on this problem directly. The ensuing review of literature will thus be directed to relevant food handlers training studies conducted using other methods of presentation. The purpose will be two-fold: one, to review some of the research that has been conducted in relation to selected approaches for teaching sanitation; and two, summerize the effectiveness of these approaches as evidenced by research.

Audio-visual Instruction

Programmed instruction is rapidly emerging as a useful tool for training and educating. When prepared by accomplished teachers, it presents the material to be learned in an organized, lucid manner and includes the essential points of each.

The audio-visual technique, of which teaching machines are a part, is one application that has possibilities of becoming an alternative in solving many training problems associated with lack of time or qualified instructors. With teaching machines, new employees can be given basic instruction before they are scheduled on the job; subsequently, a continuous program of self-training could be scheduled as needed at any time during the employees work day (6, p. 271).

Observing the problems facing hospital administrators in training unskilled food service workers at the University of Missouri Medical Center, Carter, Moore and Gregory decided to conduct a preliminary investigation into training workers by machine. The investigation was conducted to determine the effectiveness of programmed instruction as a technique for teaching non-professional food service workers. The investigators felt the teaching machine offered several advantages over a programmed textbook . . . prevents cheating . . . eliminates the need for more detailed instruction. . . provides a means for recording and scoring . . . fascinates individuals and provides a stimulus for learning (6, p. 272).

Sixty-eight randomly selected workers were assigned equally into an experimental group and a control group. The data were obtained through a pre and post test. Results of the investigation revealed that a statistically significant amount of learning occurred in the experimental group. As a result of the findings, the investigators concluded that programmed instruction is potentially an effective tool for use in training unskilled food service workers (6).

Teaching the importance of food sanitation by closed circuit TV is another technique which has proven effective. A study by Crowder gave support to the effectiveness of this technique in educating restaurant management personnel. A survey was conducted of 522 establishments in South Carolina to determine the stature of South Carolina's food protection program. An average demerit score of 74.8 was recorded before instruction. Arrangements were made with 221 schools in 46 counties equipped with closed circuit TV. A two hour course was presented to 3,818 management personnel.

The objective of the training was to change employer attitudes regarding the importance of food sanitation with the hope of eventually correlating the reduction in demerit scores with a reduction in food borne disease out breaks in the state. Initial reactions were favorable to the effectiveness of closed circuit TV. A resurvey of establishments was underway and first indications were that demerit scores were lower, especially in operational methods (7).

Another approach was presented by Rowland and Fritz using color slides. It offers versatility along with achieving a personal relationship between speaker and audience. . . presenting slides in the right manner will achieve the effect of talking to each person in the audience as though he or she were the only other person in the room (29, p. 24). They suggest five steps to food handler training which could be modified as necessary to obtain upwards of 80 percent compliance with regulations:

1. Give the food service worker the material which can be controlled for speed of presentation according to the needs of the particular group, . . .

2. go into bacteriology only far enough to give them a working knowledge but not far enough to confuse them, . . .

3. break the group up according to specific duties within the establishment; that is, operators, cooks, waitresses, etc., . . .

4. stress only those items that are found in violation most often, thereby getting greater retention, and . . .

5. create a course which is easily adapted to the group (29, p. 25).

Self-Inspection

Two pioneer studies initiated in the early 1950's, represented a turning point; away from enforcement and toward education of food handlers. The approach involved enlistment of workers and their employers to make a joint inspection of their own establishment. Self-inspection is a democratic approach to better living, a "grass

roots" health education program to benefit everyone (44, p. 744).

Vestor and Norton conducted an investigation aimed at proving self-inspection was effective in training. A preliminary investigation was conducted of 60 establishments in Rocky Mount, North Carolina, and an average violation score of 74.0 was recorded. After self-inspection the score was 92.0. On the basis of their findings, the investigators concluded that the program was successful and eventually carried it over into the public schools with the same success (44).

The New York City Health Department carried self-inspection one step further by requiring mandatory self-inspection of food plants. The law requires self-inspection to be carried out in each plant by a qualified person, either a consultant, or an employee trained by the health department. The objective of this approach is not to relieve the health department of its responsibilities, but to provide double exposure, thus utilizing the talents of both groups to reduce violation numbers (32).

Both investigations achieved some degree of success in creating an awareness and appreciation of food handling at a time when fear of the health department was at its peak.

Combination of Instructional Methods

Research studies combining various methods of presentation were essentially designed to provide a maximum amount of factual

information and encourage attitudes which would lead to behavior changes on the part of students. Thereby, food borne illness would decrease and the aesthetic values of cleanliness would be more apparent.

Dodson found 91 percent of the establishments complying with regulations in a re-survey some weeks after training 800 food service personnel in San Antonio, Texas. The investigator stated . . . as many teaching aids as possible were employed, hoping that if our information failed to reach the students in one form, it would be retained if presented in another (8, p. 191). The average food handler will take advantage of every opportunity to learn more about their job if fundamental practical knowledge is disseminated in a simple and attractive way (8).

The task of food sanitation instruction is a complex one. The background of fears in the minds of the workers and manager occasioned by stiff fines for infractions is a major obstacle in training.

Morgan and Muse aimed their approach at making food handlers health conscious and creating a spirit of confidence and interest in their problems. The study involved a series of food handler schools in six counties of Tennessee previously under the jurisdiction of the state. Five professional health educators, in cooperation with local health authorities, conducted training sessions for 700 workers. Over 80 percent of those attending completed the course and an empirical

investigation of establishments some weeks later revealed a general improvement. The investigators noted a general change in attitude throughout the six counties. The focus on education is not the panacea of all "ills" of our food protection program, but it is the only method paying lasting dividends (18, p. 28).

In evaluating a food handlers training course given by five instructors, Kerrick arrived at a different conclusion about the effectiveness of training. The study involved a statistical analysis of a required twelve hour course attended by 236 individuals. An assumption was made that a change in attitude will change behavior, which in turn will be reflected in increased compliance with laws regulating restaurants. To test this assumption, an independent survey of 106 establishments was conducted by the state health department before training. The average score was 76.0. Following the extensive training which involved all the various methods of presentation, a follow-up inspection revealed an average score of 75.6. The training course was significant in increasing knowledge of factual information, bringing the group to within two points of a perfect information score. However, the increment in test performance did not carry over into a change in job performance. The investigator noted one instructor was much more effective and suggests that training may be more effective by first selecting, on an empirical basis, the best instructor (14).

Bunge, McKinley and Montag, analyzing the effectiveness of inservice training for food service workers and the relationship of selected factors to the effectiveness of training, concluded that training has positive effects on workers. The research project was undertaken by the Institution Management department at Iowa State University to study bases for vocational education for food service employees. The experiment was based on a program for school lunch employees in Iowa. The training experiment compared: a one year experimental group that had completed the three short courses in one summer; a three year experimental group that had completed the three short courses in three different years; and, a control group that did not participate in the short course. As a result of their findings, the investigators concluded that in-service training for food service employees, including the relationships of gain in job knowledge to length of experience, education, and job responsibility, has relevance for all home economists concerned with the teaching-learning process as well as for those involved in education of food service personnel (5).

A review of the literature concerning food handlers training revealed an interesting array of informal studies and surveys with only a few well-organized, well-designed projects. The number in either case is limited.

A review of the literature leads one to believe that all methods of presentation have some degree of effectiveness, particularly when considering a particular method or technique in terms of preconceived goals, individuals or groups. It is apparent that basic research is needed into the methodology of teaching food sanitation and every effort to strive to present a better balance between content and method in these studies is needed.

CHAPTER III

Experimental Procedures

Design and Procedures Used in This Study

The major procedures used in the investigation and evaluation include: (1) selection of participants, (2) preparation of food sanitation manual, (3) selection of an equivalent food sanitation manual, (4) preparation of tests, (5) collection and treatment of data, and (6) analysis of data.

Selection of Participants

A total of 65 food service workers was randomly sampled from a total population of 138. The study group was selected from classified personnel records obtained on consent from the Director of Residence Hall Food Service at Oregon State University (Appendix E). The participants were selected from seven food service facilities on campus (Sackett Dining Hall, Arnold Dining Hall, McNary Dining Hall, West Dining Hall, Weatherford Dining Hall, Snell Dining Hall, and the Memorial Union).

Sampling was done by the use of a random numbers table (12). Three of the randomly selected workers declined to participate and two workers did not complete the testing. This left a total random sample of 60 workers who participated in the study.

A brief explanation of the study was presented either individually or in groups to the participants with assistance of dining hall dietitians

or supervisor. An honest effort was made not to coerce food service workers into participating by explaining that their involvement was entirely voluntary and dependent largely upon their interest and time.

The total group was comprised of 57 female employees or 95 percent of the total study group, and 3 men employees or 5 percent of the total group. The average age was 43.3 years. The mean years of experience was 8.2 years. Eighteen, or 30 percent of the participants, had prior food handlers training.

Preparation of Food Sanitation Manual

A food sanitation manual was developed as an educational tool for use in the study (Manual A, Appendix A). The manual was designed to instruct food service workers in basic principles of food sanitation. The main objective was to present an informative manual easily understood. Before development of the manual, an empirical investigation was conducted of several current food sanitation manuals and guides listed in the bibliography. The information was subsequently organized into three specific categories, (a) food protection, (b) personal hygiene, and (c) establishment and equipment sanitation within the manual.

Selection of an Equivalent Manual

A second food sanitation manual was selected for the study (Manual B, Appendix B). This manual was developed in 1969 by Oliver H. Johnson, Sanitarian at Washington State University for use in training food handlers at that institution. The information in this manual closely parallels that in Manual A.

Preparation of Tests

This study was concerned with the effectiveness of two food sanitation manuals in educating OSU food service workers and the a comparison of how effective each manual is in training. A pre-test, post-test design was utilized to test the following hypotheses:

1. There will be a significant gain in knowledge by food service workers due to the use of the manuals.

2. There will be a significant difference in the amount of knowledge gained by food service workers who use Manual A as compared to workers who use Manual B.

3. There will be a significant gain in knowledge by food service workers in each category of the test (a) food protection, (b) personal hygiene, and (c) establishment and equipment sanitation due to the use of the manuals.

4. There will be a significant difference in the amount of knowledge gained in each category of the test (a) food protection, (b) personal hygiene, and (c) establishment and equipment sanitation by food service workers who use Manual A as compared to workers who use Manual B.

Two equivalent multiple-choice tests, each containing 25 questions, were prepared as measuring instruments of knowledge (Test A, Appendix C and Test B, Appendix D).

Writers in the field of educational measurement are in general agreement that multiple-choice type is the most applicable of the various test forms. Anderson indicated that the multiple-choice items possess several advantages. The number of alternate responses

reduces the chances of guessing more than is the case with true-false or matching type of questions; the listing of answers stimulates thinking; the limitation of possible answers eliminates ambiguity in scoring; and, the technique of scoring is not complicated (1).

The multiple-choice tests include questions related directly to both manuals. The questions were grouped into categories as shown below.

TABLE 1. Classification of the 25 Questions From Test A and Test B by Specific Category

Name of Category	No. of Questions	Test	Test Questions
Food Protection	13	A	1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 15, 16
		B	1, 2, 3, 5, 6, 11, 12, 14, 15, 17, 20, 21, 24
Establishment & Equipment Sanitation	8	A	8, 13, 14, 21, 22, 23, 24 25
		B	4, 7, 10, 13, 19, 22, 23 25
Personal Hygiene	4	A	17, 18, 19, 20
		B	8, 9, 16, 18

The primary reason for using equivalent tests was to reduce the possibility of participants remembering or being "sensitized" to specific questions within a relatively short period of time.

Validity of Tests. In order to test the internal validity of the two tests, the tests and manuals were inspected by three professionals in public health. In addition to determining the extent to which the items in the tests correspond to the content of the manuals, the judges and the investigator edited the questions to avoid ambiguity and assure a relative degree of continuity.

Reliability of Tests. A split-half reliability test of the multiple-choice questions was computed by the Kuder-Richardson formula 20 (12, p. 459).

The Kuder-Richardson formula is a measurement of the internal consistency or homogeneity of the test material. The advantage of this formula is that it provides an estimate of the reliability of a single test from a single administration. However, because a pre-test and post-test was administered from two equivalent tests, there is a relationship between coefficients.

The reliability coefficient of pre-test A is .63, and for pre-test B .59. The reliability coefficient of post-test A is .68, and for post-test B .70. According to Baron,the lower pre-test coefficients can be attributed to a lack of knowledge and a certain amount of guessing on the part of the participants. The higher post-test coefficients

indicate learning took place (2).

Collection and Treatment of Data

The sixty participants were divided into groups of thirty by random selection. Thirty randomly selected food workers were administered Test B and then given Manual A to study. The remaining thirty workers were administered Test A and then given Manual B to study. In hopes of motivating them to study the manual before retesting, the participants were made aware of the fact that this study was for research purposes and that no one would lose his job from obtaining a low score.

A second test was administered one week after the pre-rest. On post-testing, Test A and B were interchanged between groups. Participant test results are listed in Appendix E.

The experimental design for this study is charted below:

Population	Group	Manual Used	Test Sequence
60	30	A	Pretest B, Post-Test A
	30	B	Pretest A, Post-Test B

The one-sample t test, two sample t test, and multiple analysis of covariance were used to measure whether significant differences existed between food sanitation manuals and whether there was a significant gain in food sanitation knowledge due to the use of food sanitation manuals. Regression analysis was also utilized to eliminate

disparity between the two groups brought about by differences in education, age, experience, job classification, and prior food handler training.

Programming for this analysis was recommended and approved by the Department of Statistics at OSU with computations performed by the computer center. Basic formulae used for these tests can be found in Guilford (12).

CHAPTER IV

Analysis of Statistical Data

The analysis of data was based on (1) which manual was used, (2) pre-test and post-test scores, (3) personal information received from each participant, and (4) effects of manual, test, interaction of manual and test, age, experience, and training on each category of the tests, (a) food protection, (b) personal hygiene, and (c) establishment and equipment sanitation.

The one-sample t test was calculated to test the hypothesis that there will be a significant gain in knowledge by workers due to the use of food sanitation manuals. The two-sample t test was calculated to test the amount of knowledge gained by food service workers who used Manual A as compared to workers who used Manual B. After computing the t, and knowing the degrees of freedom, the t table was consulted at the conventional five and one percent level to determine the statistical significance of the results.

A multiple analysis of covariance model was utilized to test all four hypotheses by comparing Manual A and Manual B, and the pre-test, post-test score differences in the presence of accompanying covariates of age, experience, and training. The analysis consists of the combined application of regression analysis and analysis of variance. Multiple analysis of covariance is concerned with a total

set of variations in a set of data which may be reduced to components associated with possible sources of variability. By use of this sophisticated technique, it permitted adjustments of mean scores obtained from pre-test to post-test to compensate for differences in groups.

A second application of this statistical model made possible the introduction of an additional set of data. A decision was made to analyze the three major categories of tests A and B to determine the effects of covariates on the number of errors from pre-test to post-test within each section of the test. In effect, the analysis was determining the amount of food sanitation knowledged gained.

The F test,a ratio of two means squares, was used to determine if the resulting adjusted means are statistically significant at the one and five percent levels of confidence. A large F value indicates a linear relationship and that the parameter which is being fitted is significantly different from zero. If this is found to be true, then there is a linear relationship between independent and dependent variables.

To analyze all the data simultaneously, the basic formula was further altered and became increasingly more complicated. It is beyond the scope of this study to present other than the results of the ramifications of multiple analysis of covariance statistical procedures used in this study.

In order to compare the relationship of observed means of age, experience, and training to adjusted means, a regression analysis using the post-test as the dependent variable was conducted to determine significant covariates. In the initial regression, it was determined that the variables of job classification and education did not contribute significantly to the explanation of the dependent variable and were deleted from the study analysis. The covariate regression coefficient expresses the effect of a covariate or uncontrolled variable. In this study, regression coefficients were utilized to predict a decrease in number of wrong answers of covariates significant at the one or five percent level of confidence.

Results of the one-sample t test, and two-sample t test, and multiple analysis of covariance are presented in Tables 2 through 7.

One-sample t test

The total group mean and one-sample t test results achieved on tests A and B are presented in Table 2. This includes the combined pretest scores of the sixty participants using Manual A or Manual B and the combined post-test scores.

TABLE 2. Scores of Pre and Post-test made by Sixty Participants

	Pre-test	Post-test	t-test
Range	11-24	15-25	
Median	20	23	
Mean	19.39	22.77	6.81***
Standard Deviation	2.84	2.16	

*** P < .001

The data of the total study as presented in Table 2, required a t value of 3.46 to be significant at the .001 percent level of confidence. Since the t score exceeded the .001 percent level, this means the difference could be attributed to chance factors once in a thousand times. The hypothesis that there will be a significant gain in knowledge due to the use of manuals was accepted.

Two-sample t Test

The mean scores and results of the two-sample t test achieved by workers who used Manual A as compared to workers who used Manual B is presented in Table 3.

TABLE 3. Scores of Pre and Post-test made by Participants using Manual A or Manual B.

	Manual A	Manual B	t Test
Range	16-25	11-25	
Median	22	21	
Mean	21.67	21.57	.213[ns]
Standard Deviation	1.82	1.82	

[ns]Non-significant.

The data of the thirty participants who used Manual A as compared to the thirty participants who used Manual B required a t value of 2.04 to be significant at the .05 percent level of confidence. Since the t score did not exceed this level, the hypothesis that there will be a significant difference in the amount of knowledge by workers who

used Manual A as compared to workers who used Manual B was rejected in favor of the alternate hypothesis that the manuals are equally effective in educating OSU food service workers.

Multiple analysis of covariance

The data obtained from the sixty participants was tested by this sophisticated technique to determine if the source of variance had an effect on change in number of errors made on each category of the test from pre to post-test.

The results of the effects of the manual, test, interaction of manual and test, age, experience and training on the change in number of errors made in the Food Protection category of the test is presented in Table 4.

TABLE 4. Analysis of the Effects of Manual, Test, Interaction of Manual and Test, Age, Experience, and Training on the Change in Number of Errors Made on Food Protection Questions From Pre to Post-Test.

Source of Variation	df	SS	MS	F
Mean	1	10.107	10.107	5.73*
Manual	1	.736	.736	.49
Test	1	.511	.511	.29
Interaction (mxt)	1	.408	.408	.23
Age	1	.893	.893	.51
Experience	1	4.182	4.182	2.37
Training	1	23.678	23.678	13.43**
Error	53	93.474	1.764	
Total	60	133.989		

* P < .05 ** P < .01

The data of the total study group in the Food Protection category of the tests required an F value of 4.03 and 7.13 to be significant at the five and one percent level of confidence, respectively.

The F value for the mean exceeded the .01 percent level indicating a significant gain in food protection knowledge for this category. The hypothesis that there will be significant gain in knowledge of food protection by use of manuals was accepted.

The F value was non-significant for the manuals and the hypothesis that there will be a significant difference in the amount of knowledge gained in food protection by those workers who used Manual A as compared to workers who used Manual B was rejected.

The F value for training was significant at the .01 percent level which indicated that prior food handlers training does effect change in the number of errors from pre to post-test. By applying the covariate regression coefficient for training, it was revealed that trained workers learned more than the untrained workers. The trained worker could be predicted to have .7289 less errors than the untrained worker.

The pretest raw mean score for this category was 9.80 items of correct information and the post-test score was 11.78 items of correct information out of 13 questions. This gave a mean increase of 15.2 percent and an overall mastery of knowledge tested at 90.6 percent.

The results of the effects of the manual, test, interaction of manual and test, age, experience, and training on the change in the number of errors made in the Establishment and Equipment Sanitation category of the test is presented in Table 5.

TABLE 5. Analysis of the Effect of Manual, Test, Interaction of Manual and Test, Age, Experience and Training on the Change in Number of Errors Made on Establishment and Equipment Sanitation Questions from Pre to Post-test.

Source of Variation	df	SS	MS	F
Mean	1	9.158	9.158	7.11*
Manual	1	1.176	1.176	.91
Test	1	.479	.479	.37
Interaction (mxt)	1	4.741	4.741	3.68
Age	1	2.659	2.659	2.06
Experience	1	2.868	2.868	2.23
Training	1	4.449	4.449	3.45
Error	53	68.293	1.289	
Total	60	93.793		

* $P < .05$

The data of the total study group in the Establishment and Equipment category of the tests required an F value of 4.03 to be significant at the five percent level.

The F value for the mean exceeded the .05 percent level indicating a significant gain in establishment and equipment sanitation knowledge for this category. The hypothesis that there will be significant

gain in knowledge of establishment and equipment sanitation by use of manuals was accepted.

The F value was non-significant for the manuals and the hypothesis that there will be a significant difference in the amount of knowledge gained in establishment and equipment sanitation by those workers who used Manual A as compared to workers who used Manual B was rejected.

The pretest raw mean score for this category was 6.03 items of correct information and the post-test score was 7.17 items of correct information out of 8 questions. This gave a mean increase of 14.3 percent and an overall mastery of knowledge tested of 89.6 percent.

The results of the effects of the manual, test, interaction of manual and test, age, experience, and training on the change in the numbers of errors made in the Personal Hygiene category of the test is presented in Table 6.

TABLE 6. Analysis of the Effects of Manual, Test, Interaction of Manual and Test, Age, Experience, and Training on the Change in Numbers of Errors Made on Personal Hygiene Questions from Pre to Post-Test.

Source of Variation	df	SS	MS	F
Mean	1	3.364	3.364	5.81*
Manual	1	3.310	3.310	5.71*
Test	1	.225	.225	.39
Interaction (mxt)	1	2.830	2.830	4.88*
Age	1	.653	.653	1.13
Experience	1	.074	.074	.13
Training	1	.000	.000	.00
Error	53	30.717	.579	
Total	60	41.173		

* $P < .05$

The data obtained from the total study group for the Personal Hygiene category of the tests required an F value of 4.03 to be significant at the .05 percent level.

The F value for the mean exceeded the .05 percent level indicating a significant gain in personal hygiene knowledge for this category. The hypothesis that there will be a significant gain in personal hygiene by use of manuals was accepted.

The F value for the manuals exceeded the .05 percent level indicating that there was a significant difference in the amount of personal hygiene knowledge gained between Manual A and Manual B. The hypothesis that there will be a significant difference in the amount of knowledge gained in personal hygiene by those workers who used Manual A as compared to workers who used Manual B was accepted.

The F value for manuals and the interaction of manuals and tests exceeded the .05 percent level indicating that test difficulty depends upon which manual was used. The manual most effective in reducing the number of errors in personal hygiene was determined from adjusted means of performance for age, experience, and training. Manual A decreased the number of errors from pre to post-test by 1.20 whereas, Manual B decreased the number by .70. A difference of .50 less errors is noted by use of Manual A.

The pretest raw mean score for this category was 3.37 items of correct information and the post-test score was 3.83 items of correct

information out of 4 questions. This gave a mean increase of 11.5 percent and an overall mastery of knowledge tested of 95.7 percent.

The results of the effects of the manual, test, interaction of manual and test, age, experience, and training on the change in the number of errors made in all three categories of the test is in Table 7.

TABLE 7. Analysis of the Effects of Manual, Test, Interaction of Manual and Test, Age, Experience and Training on the Change in Number of Errors Made on Total Question From Pre to Post-Test.

Source of Variation	df	SS	MS	F
Mean	1	63.334	63.334	26.71**
Manual	1	.000	.000	.00
Test	1	.388	.388	.16
Interaction (mxt)	1	1.608	1.608	.68
Age	1	11.185	11.185	4.72*
Experience	1	12.268	12.268	5.18*
Training	1	47.785	47.785	20.18**
Error	53	125.662	2.370	
Total	60			

* $P < .05$ ** $P < .01$

The data obtained from the total study group for all three categories of the tests required an F value of 4.03 and 7.13 to be significant at the five and one percent level of confidence, respectively.

The F value for the mean exceeded the .01 percent level of confidence from pre to post-test indicating a significant gain in basic food sanitation knowledge. The hypothesis that there will be

a significant gain in knowledge by food service workers due to the use of the food sanitation manuals was accepted.

The F value for manuals was non-significant at the .05 percent level indicating that there was no significant difference between Manual A or Manual B. The hypothesis that there will be a significant difference in the amount of knowledge gained by food service workers who used Manual A as compared to workers who used Manual B was rejected in favor of the alternate hypothesis that they are equally effective in educating OSU food service workers.

The F value of age exceeded the .05 percent level indicating that age of a worker did affect their learning. By applying the covariate regression coefficient for age, it was revealed that older workers learned less and could be predicted to have .4101 more errors for any level of experience or training.

The F value for experience exceeded the .05 percent level indicating that experience of a worker did affect their learning. By applying the covariate regression coefficient for experience, it was revealed the experienced workers learned more and could be predicted to have .8110 less errors for any level of age or training.

The F value for training exceeded the .01 percent level indicating that prior food handlers training by workers highly affected their ability to learn. By applying the covariate regression coefficient for training, it was revealed that the trained worker could be

predicted to have 2.0363 less errors than untrained workers. The trained worker thus scored high on pretesting and learned less for any level of age or experience.

To further bring out the significance of age, experience, and training in educating OSU food service workers, covariate regression coefficients were applied to average age (43.3), average experience (8.2), and average training (.37). The average decrease in number of errors from pre to post-test was 3.38; however, when the average was adjusted for age, experience and training, the decrease was 1.73 less errors. This decrease could be predicted for a worker having 8.2 years of experience, being 43.3 years old and having had prior training. This indicates a workers predicted score will deviate from the adjusted figure of 1.73 depending upon his individual background.

Before studying the manuals, workers averaged 19.39 items of correct information and after reading and studying the manuals, they averaged 22.77 items of correct information. This gave a mean increase of 13.6 percent and an overall mastery of 91.0 percent in basic food sanitation principles.

CHAPTER V

Summary, Conclusions, and Recommendations

Summary

The objectives of this study were to determine the effectiveness of two food sanitation manuals in educating Oregon State University food service workers and to compare the effectiveness of the two manuals.

Sixty food service workers selected at random from seven campus dining halls were tested by equivalent multiple-choice tests judged valid and reliable. The data collection was accomplished by a pre and post-test. Thirty workers were administered Test A and then given Manual B to study. The remaining thirty workers were administered Test B and then given Manual A to study. Manuals were studied by workers for one week and then they were retested. Tests A and B were interchanged on the post-test.

Hypotheses were tested by:

1. Two-sample t test to determine significant differences in means between test scores of workers who use Manual A as compared to workers who used Manual B.

2. One-sample t test to determine if the manuals are effective in teaching food sanitation, and

3. Multiple Analysis of Covariance to determine the effects of selected factors on the change in numbers of errors made from pre to post-test on each category of the tests as well as the total test.

Regression analysis was applied to covariates of age, experience, and prior training significant at the one or five percent level to determine effects on a workers gain in knowledge. The initial regression analysis revealed job classification and education were not significant in influencing a workers gain in knowledge and were thus deleted from further analysis.

It was found that food sanitation manuals A and B are effective in educating OSU food service workers. The significance was at the one-tenth percent level when tested by the t test, and one percent after adjusted for covariates. When mean gain of workers who studied Manual A was compared to those of workers who studied Manual B, Manual A was found to have no significant advantage statistically in the amount of knowledge gained. In analysis of each category of the test, Manual A was found to be more effective in educating workers in personal hygiene. The significance was at the five percent level.

Regression analysis of covariates revealed that older workers learned less for any level of experience or training; experienced workers learned more for any level age or training; and that trained workers scored a high initial score and thus learned less by use of the manuals for any level of age or experience.

It was concluded that workers who studied either manual A or B will gain significantly in food sanitation knowledge in all three categories of the test as well as on the total test; however, workers

studying from Manual A will gain significantly more personal hygiene knowledge. It was further concluded that age, experience, and prior training does have a definite influence on educating OSU food service workers.

Conclusion

Based on the results of this study, the following conclusions may be drawn:

1. Food sanitation manuals A and B are effective in educating OSU food service workers.
2. Food sanitation manuals A and B are effective in educating OSU food service workers in each category of the test.
3. The two food sanitation manuals, as instructional tools, were not significantly different statistically in their ability to teach. With one exception, workers who used Manual A were found to have gained more knowledge about personal hygiene.
4. Older food service workers learned less for any level of experience or prior training.
5. The more experienced food handlers learned more for any level of age or training. This suggests that workers with some experience are more amenable to learning factual information about food sanitation and the relationship

between their business and food borne disease.

6. Food service workers with prior food handlers training scored high initially on the pretest and did not gain a greater amount of knowledge about food sanitation for any level of age or experience.
7. A food service worker's level of education and job classification had no effect on the amount of food sanitation knowledge gained.
8. The multiple-choice tests used in this study were found to be reliable as instruments of measuring the gain in basic food sanitation knowledge.

Recommendations

The value of food sanitation manuals in educating food service workers requires further study. Attention should be directed into the effects training manuals have in changing job performance and establishing good employee practices.

Results of this study indicate sanitation manuals are effective instructional tools. If qualified teachers or staff are unable to perform adequate instruction, an approved sanitation manual should be required reading as a part of job orientation or in-service training. A test similar to those used in this study could be administered to evaluate the knowledge of incoming employees. If results reveal an

insufficient amount of basic knowledge of food sanitation, instruction should be forth coming regardless of that employees past experience, age, or prior training.

Follow-up training for untrained or inexperienced food service workers, once they have been on the job approximately one month, should be required to re-emphasize food sanitation knowledge and to provide for a better understanding of its underlying principles.

Supervisors should be given periodic in-service training since the training of employees is their ultimate responsibility.

Evidence from this study suggests that workers with prior instruction did not benefit greatly from the food sanitation manuals. Efforts should be directed toward developing a more advanced manual or some other method of instruction to stimulate interest and learning of that group.

Finally, evidence from this study suggests that older workers are less amenable to training. Further study is needed to determine appropriate methods for effectively training these workers.

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APPENDICES

APPENDIX A

SANITARY FOOD SERVICE MANUAL

FORWARD

To look is one thing
****
To see what you look at is another
****
To understand what you see is a third
****
To learn from what you understand is still something else
****
But to act on what you learn is all that really matters*

Each year food-borne disease (any illness transmitted through food) afflicts thousands of people. Though not usually of a crippling or fatal nature, such diseases nonetheless cause enormous loss of time from work or school. Food sanitation in the university dining hall is particularly important since food is prepared for service to a relatively large number of students at one time, all of whom would be subject to illness if the food were not safe and wholesome.

Some foods enter the kitchen already contaminated with insecticides and food poisoning organisms. Lack of sanitation, poor personal hygiene, or improper storage and preparation of this same food may further contaminate it before it is served. Alone, these factors are rarely responsible for food poisoning. However, allow this contaminated food to remain at or near room temperature for long periods of time and an explosive outbreak of food-borne illness will develop.

The most important fact which the food service worker should know is: ALL FOOD-BORNE ILLNESS CAN BE PREVENTED.

The goal of this Sanitary Food Service Manual is to help you become familiar with some of the many factors associated with safe food service.

To understand when your hands should be washed and why.

To understand how to care for food properly.

To know the temperature of the wash and rinse water in the dishwashing machine and why these temperatures are necessary.

*"The Thalco Trainer", Washington Restaurant Association.

GERMS AND PEOPLE

THE GERM OF IT ALL

Savages know little about germs!

They believe that sickness is caused by evil spirits that invade and torture the body.

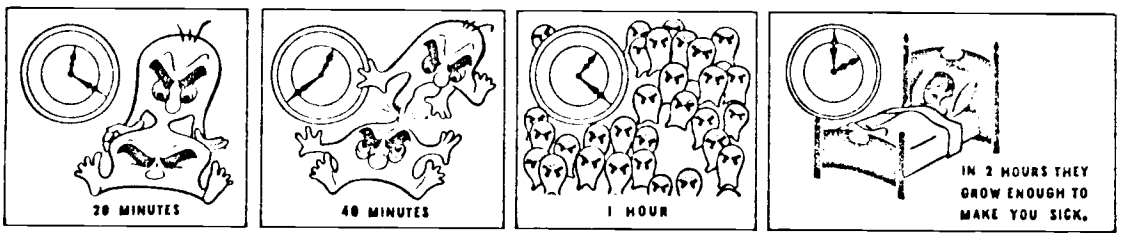
Germs are really living things; and like other living things, they have certain needs in order to survive.

What are these needs?

Food
Warmth
Moisture
Time to Grow

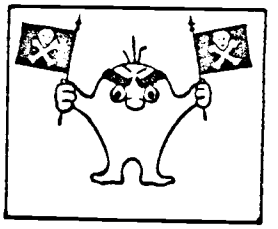
Bacteria are all around us, on our skin, in our hair, in the air, and on eating utensils and equipment. They are small enough that it would take 25,000 of them to make one inch.

The mere presence of these germs is not dangerous. However, when they get enough food, warmth, and moisture; they grow and increase in numbers with unbelievable speed.

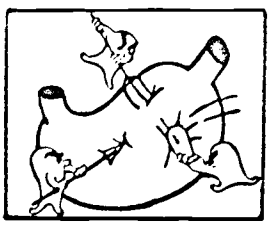


HOW DO BACTERIA CAUSE DISEASE?

Some bacteria growing in food may cause illness by throwing wastes into our food when they grow. These wastes are poisonous to us when we eat the food. It is the poison or toxin that makes us ill. Staphylococcus and Botulism poisons are two examples.



Other bacteria get into our body and multiply and tear down our body tissues. Salmonella is the germ most often involved here.



In whatever way they do it, germs can make us ill!

CERTAIN FOODS ARE DANGEROUS

Foods may contain these dangerous germs and poisons without showing any change in appearance or odor. Unfortunately, the foods most desired by these germs are also our favorite foods. They are usually called potentially hazardous foods.

What are some potentially hazardous foods?

If you named -

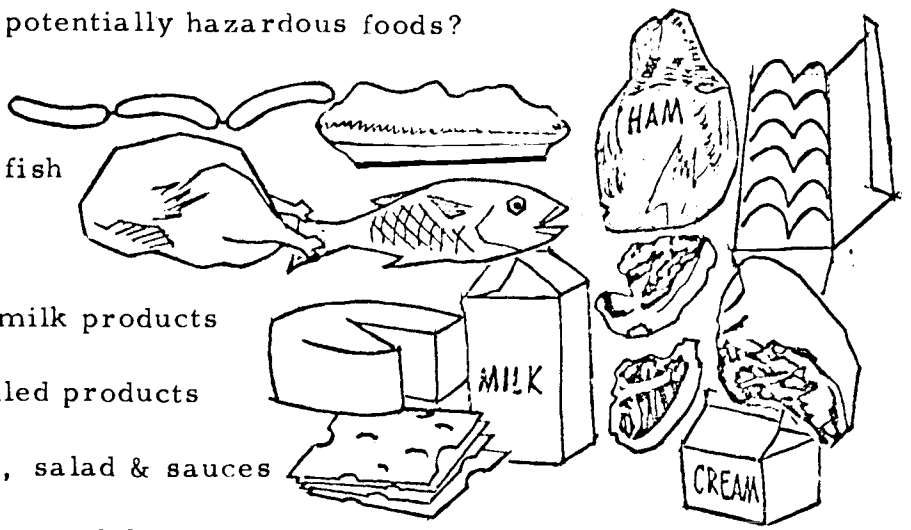
meat and fish

poultry

milk and milk products

cream-filled products

dressings, salad & sauces



You've named most of the foods involved in food-borne illness.

PERSONAL HYGIENE

Case History: 72 persons experienced upset stomachs and diarrhea within 5 hours after their evening meal. Egg salad was the suspected food. The eggs were boiled and shelled early that afternoon. One of the cooks then added mayonnaise and relish to the chopped eggs. After preparation, the salad was not refrigerated right away. The cook who prepared the salad had an infected cut, but continued to work.

Poor personal hygiene or careless habits in the kitchen are usually done without thinking - the cook who tastes everything with the same spoon - the employee who wets a finger to help pick up a sandwich bag or turn a page in the receipe book - or the worker who digs or scratches their nose or head. They're all helping germs get from place to place.

KEEP HARMFUL BACTERIA OUT OF FOOD

Germs don't get into food under their own power. They "hitch-hike" on an insect, a worker's hand, a meat slicer, a cough or sneeze, unclean dishes, or an infected cut - on almost anything!

"If he has such a bad cold, wouldn't it be simpler and safer to send him home?"

Admittedly, we can't keep all bacteria out. It's hard to do even in a hospital surgery. But, WE CAN do a very good job of keeping out disease-type bacteria - we know where they are usually found.

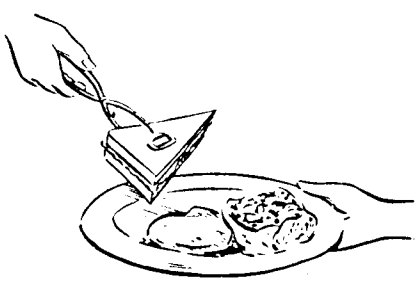
The HUMAN HAND, it really gets around! If your hands are loaded with harmful germs at food preparation time, there's really not much of a point in spending time following good food handling techniques.

Certain food preparation steps require limited but direct handling of food. Expert food service workers do it the least! Excessive handling just doesn't make it taste better.

TAKE A MOMENT TO SIZE UP YOUR PERSONAL PRACTICES IN THE KITCHEN

Can they be improved? Here are some reminders.

*Don't touch food more than necessary - Use clean utensils to pick up food or to mix food during preparation. Use throwaway (single-use) gloves whenever possible.



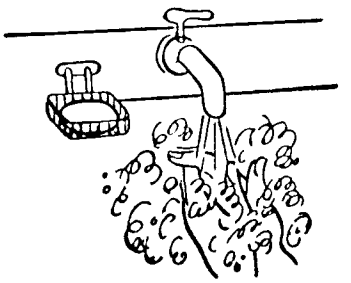
*Stay clean on the job. Keep hands clean at all times; WASH THEM

Before

- Beginning work mornings
- any job where hands must br placed in the food
- serving food

After

- returning from toilet
- using a handkerchief
- coughing or sneezing
- handling hair or face
- smoking or handling garbage
- handling unwashed or uncooked food



*Be clean when you come to work

- bathe every day
- wash your hair, keep it up
- don't wear rings or other ornaments while preparing food
- wear clean clothes to work and during work
- clip your fingernails frequently
- check with your supervisor if you have any illness, cut, or sore

Don't drop your hair in the soup

Wear a head-band, hair-net, or cap

Don't cultivate a germ garden

Use a 10-cent nail file

*Apply First Aid to any injury, no matter how slight. It's the infected cut that contains dangerous germs

*Don't touch food contact surfaces - Like the edges of glasses, tops of plates, tines of a fork, or edges of knives.

FOOD PROTECTION

SOURCES OF FOOD

The actual purchase of food used in your kitchen may be out of your control, however, as an employee, you must be aware that unless the food is clean to begin with, no amount of careful handling will prevent a food-borne illness.

* Treat food as if it might have been contaminated when delivered - with care.

* Fruits and vegetables may be contaminated with insecticides or some type of disease germ. ALWAYS CLEAN ALL FOOD THOROUGHLY BEFORE COOKING OR SERVING.

REMEMBER: Take no chances with spoiled foods - If you are not sure it is safe - GET RID OF IT.

FOOD PREPARATION

Why is PREPARATION a most important sanitation link?

* Because, during preparation, the unwrapped food is unavoidably exposed to many potential sources of contamination.

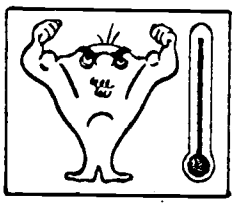
* Because, slicing, mixing, portioning and the other preparation steps are most often performed at room temperature where harmful bacteria can grow dangerously fast.

*Because exposure to human contact, coughing and sneezing is most likely to occur during this period.

The PREPARATION PERIOD is the most sensitive one in the entire production chain as far as allowing enough time and the right temperature for germs to grow.

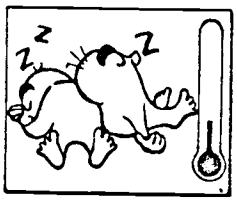
The goal is simple

* Reduce any unnecessary periods during preparation in which the food is held at dangerous temperatures - above 45°F or below 140°F.



Bacteria grow best in warmth

Below 40°F. temperature they sleep



Are there any unnecessary time losses during preparation in your kitchen?

Here are some TIME AND TEMPERATURE tips

* Thaw frozen foods in the refrigerator, or for a quicker method use cold running water, or cook while still frozen.

* Cook meat, poultry, stuffing, and stuffed meat as well as other foods safely and thoroughly to a temperature of 150°F, or above.

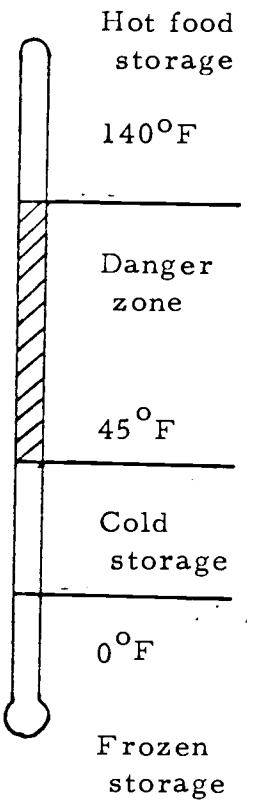
* Keep a meat thermometer in the kitchen. Use it to determine when a proper temperature of the food has been reached

* Stir large masses of food such as soups and gravies frequently to assure even cooking throughout, better yet, use several small pans.

* Serve food soon after cooking, or refrigerate promptly at 45°F, or below.

* Hold cooked foods prior to serving at 140°F, or above.

* After slicing, chopping, mixing, etc., return the food to refrigeration unless the next step is to follow right away.



What makes Potentially Hazardous Foods dangerous if held at room temperature, or in warm water, for more than 3 or 4 hours?

- Because, all are high in moisture
- Because, most are handled considerably in normal preparation
- Because, most are mixed with several other ingredients
- Because, all are nutritious - good for you

These foods, whether raw or cooked, should not remain out of refrigeration longer than absolutely necessary -- CERTAINLY NOT MORE THAN 1 HOUR.

REHEATING LEFTOVERS AND COOKED FOOD

Case History: A cafteria had recently reported a number of people sick. Clam chowder was prepared from frozen clams, vegetables, and milk and was refrigerated in 5 gallon containers. Chowder was placed in a pot and reheated in a water bath. It took four hours to raise the temperature to 140° F

during the busy lunch period.

Slow reheating allows time for germs to grow. Warming or holding units such as steam tables are not designed to heat food. They are not capable of reheating refrigerated food quickly either.

* When rehating leftovers or cooked foods, heat quickly and thoroughly to temperatures of 150°F. to 165°F. or above.
* Boil broth and gravies several minutes when reheating.
* When adding, or mixing ingredients, make sure that they are properly cooked.
* Dispose of foods which have been served to customers, but are not eaten.

REMEMBER: Keep it hot or keep it cold or don't keep it long!

STORAGE

WHY FUSS ABOUT REFRIGERATION?

The answer is simple, germs don't grow very well in cold. Even freezing will not necessarily kill bacteria. It keeps or preserves them along with your favorite steak.

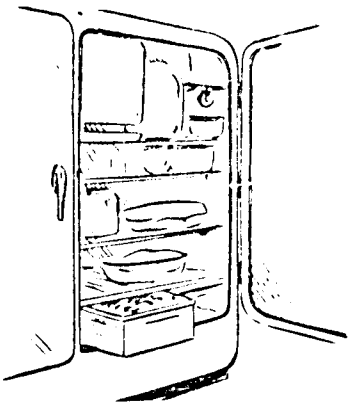
When cooling hot food, place it directly into the refrigerator. Modern refrigerators are capable of cooling foods rapidly without allowing spoilage.

Pre-cooling at room temperature is a bad practice. Germs are apt to grow during this kind of cooling process and the product may be further contaminated by dust or a careless sneeze.

HOW CAN WE KEEP GERMS FROM GROWING AND CAUSING DISEASE AND SPOILAGE?

* Store food at 45°F. or cooler.
* Keep a thermometer in the refrigerator, check it frequently.
* Keep the refrigerator clean.
* Cover all food to protect from overhead dripping and contamination.
* Don't overcrowd the refrigerator - allow cold air to circulate.

*Separate raw foods from cooked foods whenever possible to reduce chances of contamination from blood drippings, etc.



REMEMBER: Refrigerate perishable foods as soon as they are received, or immediately after preparation.

DRY STORAGE

Dry food, canned goods, and other supplies will not keep forever. Proper protection and preparation of these foods requires sanitary storage practices. A neglected storage room is easy to spot.

Take a look the next time you go after something. WHAT THINGS COULD BE IMPROVED?

Here are some hints on what to look for:

* Is the storage room arranged so as to be easily cleaned?

* Are containers of food including bulk foods such as sugar and flour stored off the floor on racks or shelves?

* Are soaps, poisons, chemicals and cleaning supplies separated from food products and clearly marked?

* Is the room pest free? Look for live rodents and insects. Check for droppings on shelves. See if the room is vector-proof.

* Are old foods moved to the front when new supplies are stored? REMEMBER - "first in" - "first out". Keep your food moving, avoid stockpiling.

RODENTS AND INSECTS

Rodents and insects are found wherever food, garbage, or waste is present. Wherever they go they leave germs and deposit filth.

Maintaining a pest-free kitchen requires your help.

* Keep outside doors closed.

* Clean up any crumbs and food particles.

* If insecticides are used - keep food covered and clean table tops after you are finished.

ESTABLISHMENT & EQUIPMENT SANITATION

Lack of sanitation in the kitchen along with improper washing and sanitizing of equipment provide ideal places for germs to live.

HOW CAN WE KEEP A CLEAN KITCHEN?

* By cleaning every surface that food and tableware touches such as storage areas, preparation areas, dining areas, and dishwashing areas.

* By removing dirt and dust from every place where food is stored, served, or prepared such as window ledges, lighting fixtures, walls, floors, storage shelves, etc.

* By helping to keep employee and public restrooms clean.

RECONTAMINATION OF COOKED FOODS

It is impossible to prepare food without allowing it to touch cooking surfaces of equipment and utensils. Our only safeguard against germs is to make sure that each is free of food residue and grease.

> Case History: Baked ham was served to a large group of students at a dormitory lunch room. 51 students became ill. During the investigation, it was found that 2 frozen ducks were prepared on the same cutting board before the baked ham was sliced. The baked ham was left at room temperature for some time before it was served.

A common food handling error is the transfer of germs from raw to cooked food. The surface of a work table or cutting board used for both raw and cooked foods must be cleaned and sanitized (killing all disease germs) after each use. BETTER YET, keep these two operations separate.

REMEMBER:

* Clean and sanitize food contact surfaces after each use. Use warm water, a bleach or other sanitizer, and a clean cloth on such things as cutting boards, mixers, and grinders.
* Check utensils for uncleanable surfaces (pits, scars, etc.) Call them to the attention of your supervisor.
* Clean counter and table tops often to remove food residue and grease.
* Clean grills, ovens, and tops of stoves at least once each day.

DISHWASHING AND SANITIZING

Dishwashing is one of the most important factors associated with safe food service. Even a clean dish may have thousands of germs on it.

Dishes cannot be properly washed, either by hand or by machine, unless you understand and follow every step in the dishwashing process.

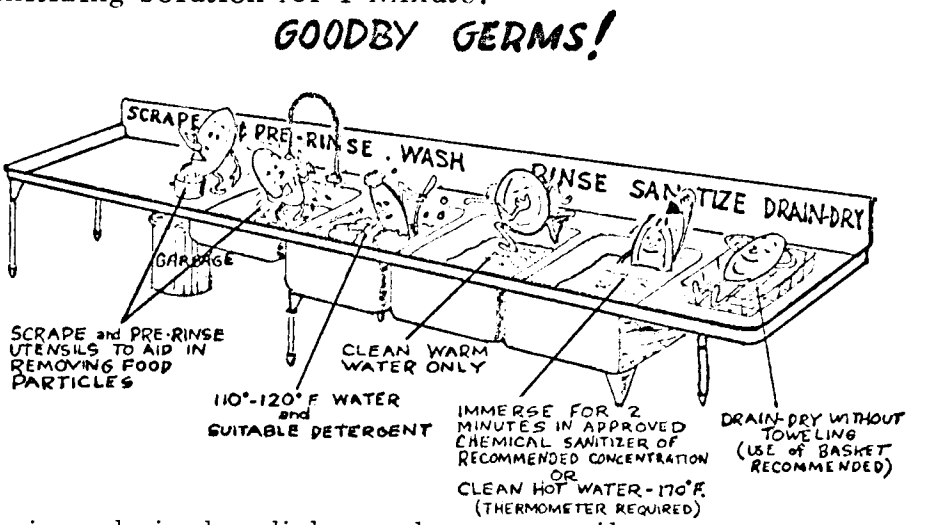
The steps for hand dishwashing are:

* Carefully scrape and pre-rinse all utensils. If no pre-rinse sink is provided, use a shallow pan of water and brush to remove any food on the plate.
* Wash in water of 100°F. or as reasonably hot as your hands can stand. Use any satisfactory detergent. Stack washed

dishes in baskets for rinsing and sanitizing. Change water as needed. Dirty wash water cannot produce a clean dish. Keep detergent concentrations up.

* Rinse in a second compartment of clean, hot water.

* Sanitize in a third compartment of clean, hot water with sanitizing solution for 1 minute.



* Drain and air dry dishes, glasses or silverware.

* Store clean dishes and utensils on shelves to avoid mop splashing. Store cups and glasses with their bottoms up.

* Keep clean dishes away from dirty dishes.

The steps for automatic dishwashing are:

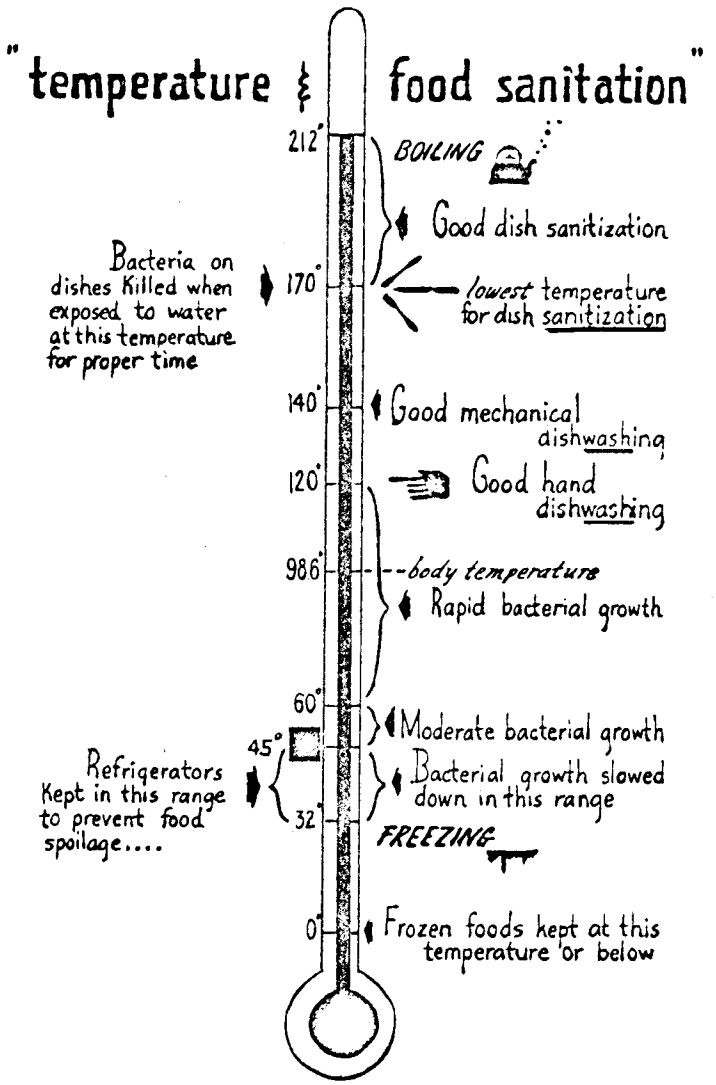
* Scrape and pre-rinse to remove large food particles.

* Rack dishes of the same size or type together and allow enough space for complete washing.

* Wash for not less than 40 seconds in water of 140°F. to 160°F. Check thermometer on the machine. If wash water is allowed to get too hot, the remaining food may cook right onto the utensils.

* Rinse for at least 10 seconds at 170°F. - to insure germ kill.

* Air dry.



Directions may vary with different automatic dishwashing machines. Follow the instructions that accompany your machine.

REMEMBER: DISHWASHING MACHINES GIVE SATISFACTORY RESULTS ONLY IF OPERATED ACCORDING TO DIRECTIONS.

THINGS TO REMEMBER FOR SAFE FOOD OPERATION

CLEAN HANDS - Clean hands can prevent the spread of germs. Hands and fingernails should be washed with soap and water before work, after using the toilet or before handling food.

HEALTHY WORKERS - Food workers must be healthy, for colds and other diseases may be passed to others. Germs from infected cuts, pimples or boils may cause food poisoning.

SAFE FOOD - Food must be protected during storage, preparation, display, and serving. Remember, foods may be infected by coughs, sneezes, handling, dirty equipment, rats, flies, or cockroaches, and garbage.

CLEAN SERVICE - Multi-use utensils and equipment should be washed, rinsed, and sanitized after each use. Equipment and surroundings should be kept clean. Remember that handling or storing utensils the wrong way can spread disease.

RIGHT TEMPERATURE - Cold stops germs from growing, cooking kills them. Keep food under 45°F., or above 140°F., or do not keep it. Prepared food should not be left at room temperature.

APPENDIX B

FOOD SERVICE WORKERS' MANUAL

Introduction

The food service industry is one of the largest in the United States with over 38,000,000,000 meals served each year. This shows, either by choice or necessity, a vast number of people depend upon you for safe food.

Many foods are contaminated with food poisoning organisms before entering your establishment. This same food may become further contaminated by improper storage or preparation prior to its being served. Both of these factors are potentially dangerous, but, by themselves, are rarely responsible for food borne illness. However, allow this contaminated food to remain at or near room temperatures for extended periods of time and an explosive situation will develop.

Many of us involved in providing food to the public are often not aware of the potential consequences of improper food handling.

The purpose of this manual is to help you become familiar with the many factors associated with safe food service.

Food Preparation and Storage

The organisms that cause food borne diseases have some basic needs that must be met in order to cause illness. These needs are a suitable food supply, proper temperature conditions and a sufficient length of time to reproduce themselves. Unfortunately, the foods most

desired by these germs are also our favorite foods. These foods, usually called potentially hazardous foods, include all meats, poultry and poultry products, fish, milk and milk products, meat casseroles, cream filled pastries and custards. Bacteria are all around us and are present in most of the food we eat. The mere presence of these organisms is not necessarily a dangerous situation. The bacteria must be present in large numbers before contaminated food will cause illness. In other words, in order to cause trouble, food poisoning organisms must reproduce and they can and only do this under certain conditions of suitable food supply, proper temperatures and sufficient time. Given the right conditions; small numbers of organisms can multiply into millions within 2 or 3 hours. Realizing that the vast number of bacteria present all around us make it virtually impossible to prepare sterile food; it is apparent that our best defense against food-borne illness is to keep foods at temperatures not suitable for bacterial growth. These temperatures are 45°F. or less, or 140°F. or higher.

FOOD PREPARATION

Recontamination of Cooked Foods

> Case History: Roast beef served by a caterer to a large group of people at a reunion dinner caused a considerable number of people to become ill. Investigators discovered that two frozen turkeys were prepared on the cutting board prior to the slicing of the beef. The sliced beef was left at room temperature for four hours before it was served.

A frequent food handling problem in food service establishments is the contamination of cooked foods by raw foods. Cooked products such as roasts, fried chicken, gravies, casseroles, or dressings should be kept away from raw food items and the utensils used in handling raw foods. This means that either separate cutting boards, preparation tables, etc., need to be provided for cooked and raw foods or that such equipment be thoroughly cleaned and sanitized before coming in contact with cooked foods.

Refrigerating Hot Foods

> Case History: A local restaurant catered to a company picnic at which many people became ill. The offending food was potato salad. Approximately 100 pounds of salad was prepared in a large aluminum tub and placed in the walk-in refrigerator over night. The refrigerator temperature was 45°F. but the middle portion of the salad remained at incubating temperature for several hours.

When cooling hot foods, they should be placed directly into the refrigerator. Today's refrigeration equipment is capable of cooling these foods rapidly without causing spoilage. Foods handled in this manner will not "sour". Large containers or quantities of food cool much slower than smaller portions; therefore, it is important to distribute large food quantities into several smaller containers to obtain rapid cooling.

Use of Thermometers

The key to safe preparation of foods is temperature control. This is particularly important when cooking poultry, pork or beef products. Poultry should be cooked to an internal temperature of at least 165°F., pork should be cooked to 150°F. or higher, and beef should be cooked to 140°F. or higher. The best way to determine when proper temperatures have been reached is through the use of a meat thermometer.

After cooking, hot foods must be maintained at 140°F. or higher until serving. Large food masses such as casseroles, soups or gravies should be stirred frequently to obtain even temperature throughout.

Frozen Foods

Frozen foods should be cooked frozen or thawed in a refrigerator or under cold running water.

This is especially important for large items such as frozen turkeys. If, for example, turkey was thawed at room temperature the skin surface would be at room temperature for a number of hours before the interior of the bird was thawed. This would be enough for any food poisoning organisms present to multiple rapidly.

Reheating

> Case History: A restaurant whose specialty was clam chowder had several reported food poisoning outbreaks. Chowder was prepared from frozen clams, fresh vegetables and milk and was refrigerated in five gallon

containers. Chowder was placed in a pot and reheated in a water bath. It took four hours to raise the temperature to 140°F. and during busy periods the chowder was served lukewarm.

When rehating cooked foods, they should be brought to 140°F. or above as rapidly as possible. Slow heating allows time for bacterial growth to occur which may cause some serious problems. Warming or holding devices such as steam tables are not designed to heat food and are not capable of reheating refrigerated foods quickly. These devices should not be used for reheating foods.

FOOD STORAGE

Case History: Turkey and dressing eaten on Easter Sunday at noon, and during the afternoon and evening, at a large restaurant caused 145 persons to become ill. Investigation showed that refrigeration space was not adequate to handle the large amount of food prepared and that stuffed turkeys were left on kitchen tables before and after baking.

All foods delivered to an establishment should be properly stored immediately. Potentially hazardous foods such as meat and meat products, fish, poultry and dairy products (including cream, custard and meringue baked goods) need to be refrigerated promptly.

Refrigerated Storage

During refrigeration, foods should be protected from overhead contamination by covering containers of food. This will protect the food from water, juices and other food products or foreign particles dripping from the storage shelves into food stored below. Store raw

meats in a separate area away from cooked foods whenever possible. This will prevent blood and juices from dripping onto other foods.

Proper refrigeration of foods is not possible when equipment is overcrowded. Overcrowding of refrigerators causes warmer air temperature. This not only reduces the shelf life of the stored foods, but can also cause these foods to be unsafe for consumption. In order for refrigerators to be efficient, food should be stored in such a way so that cold air circulates freely around all food containers. The air temperatures required for satisfactory refrigeration is 45°F. or less.

Dry Food Storage

Foods which do not require refrigeration should be stored so that the storage areas may be easily cleaned. Store off the floor and away from walls to make sweeping easier. Storage away from overhead sewage or water lines helps prevent damage from flooding. This type of storage combined with regular cleaning of the area helps eliminate food and housing for insects and rodents.

Summary

The key factors in the storage and preparation of food are time and temperature. Potentially hazardous foods should not be held at room temperature for more than three cumulative hours from the time the food is received until it is ultimately served to the consumer.

To prevent multiplication of food poisoning organisms, potentially hazardous food should be kept at 140°F. or above or 45°F. or below. IN OTHER WORDS, KEEP IT HOT OR KEEP IT COLD.

Equipment

Important to any job are the tools and equipment that are used. The tools used in the food industry, as in other industries are specifically designed and constructed for a particular job.

Any piece of equipment, in order to work efficiently, must be properly maintained. Food maintenance includes routine cleaning of all equipment used in food service operation. The regular cleaning of large pieces of equipment such as ranges, hoods and hood filters, grills and refrigerators is expected by the public. Beyond that, however, the regular cleaning of these items helps maintain the efficiency, reduces repair and replacement costs and helps prevent rodent and insect infestations.

Cleaning and Sanitizing

Smaller utensils such as pots and pans and eating utensils should be cleaned after each use. Whether your particular establishment washes dishes by hand or uses a dishwashing machine, there are some basic principles that apply to both types of washing procedures.

These principles are:

(1) Scrape dishes to remove large food particles.

(2) Pre-rinse.

(3) Wash in hot water (110°-120°F. for hand washing, 140°-160°F. for machine washing).

(4) Rinse in clean water.

(5) Sanitize (Hand method - 170°F. water for 1/2 minute, 50 ppm. chlorine for one minute) (Machine - 170°-180° F. water).

(6) Air dry.

In operating mechanical dishwashing machines, it is a good idea to follow the recommendations of the manufacturer.

In both types of operations it is important that:

(1) Proper detergent and sanitizing agent concentrations be maintained.

(2) Wash water is changed as needed.

(3) Correct water temperatures are maintained.

Cleaned and sanitized equipment and utensils should be stored on clean surfaces and in areas protected from splash, dust or other contamination.

Single Service Items

Single service items such as paper plates and cups, plastic spoons, etc., are used in many establishments where quick service is needed. These utensils are perfectly acceptable providing they are stored as any other food contact utensil would be stored and are discarded after use.

Approved Equipment

> Case History: 14 of 25 persons became ill after drinking fruit punch served in a coffee shop. The punch had been prepared in a galvanized iron container, then stored in the refrigerator. The acid in the punch corroded the container, dissolving a considerable amount of zinc from the container lining.

Some of the key factors important in the design of food service equipment are the use of non-toxic and easily cleanable materials and ease of maintenance. Public health officials and the food service industry have established the National Sanitiation Foundation (NSF) which sets design and performance standards for equipment and issues a seal of approval to those items meeting these standards. Using the NSF standards as guidelines, your local health department will be able to answer any questions you might have concerning the acceptability of a specific piece of equipment.

Personal Hygiene

> Case History: 52 cases of shigellosis (a severe diarrheal illness) were reported among persons eating in the dining room of a dormitory. Shigella sonnei was isolated from

> fecal specimens of patients and from a cook. The cook became ill with diarrhea about 5 days prior to the outbreak but continued to work. The outbreak was attributed to the cook's poor personal hygiene.

You are one of the first things a customer notices. He notices whether or not your uniform is clean, the cleanliness of your hands, whether or not your appearance is neat, including the way your hair is fixed. These things are all important to the customer and he uses them in forming an opinion about whether or not he likes or dislikes the particular establishment you are employed with. Some of the things you do are also noticed by the customer and may leave a bad impression. This would include picking your nose, scratching, smoking while on duty and handling food contact surfaces or utensils (e.g., eating surfaces of silverware or plates, rims of glasses) when setting or cleaning the table.

These are all fairly obvious mistakes and most of us are aware of them even though we are not always conscientious in our effort to avoid them. However, the most important habit for a food service worker to develop is not easily noticed by the customer. That is, food workers should <u>wash their hands frequently throughout the day</u>. It is important to wash your hands after visiting the toilet. It is equally important that you wash your hands when you change duties. For example, when going from emptying garbage to washing dishes or from cleaning tables to setting tables or from smoking on your break to serving food, YOU SHOULD ALWAYS WASH YOU HANDS.

Summary

Good personal hygiene encompasses such grooming habits as neat appearance and avoiding of scratching, etc. It also includes proper handling of eating utensils whether serving food or cleaning tables. The most important aspect of personal hygiene is the frequent washing of hands before handling food.

REVIEW QUESTIONS

1. What are some basic needs of food poisoning organisms?
2. What are some examples of potentially hazardous food?
3. What hazards are associated with overcrowded refrigerators?
4. What are some basic dishwashing principles?
5. How can frozen food be thawed safely?
6. How can poor personal hygiene habits affect a food service establishment?

APPENDIX C

MULTIPLE-CHOICE

Test A

QUESTIONS

NAME_____

AGE _____

Present Position _____

Years of Experience in Food Service _____

Previous Food Handlers Training -- Yes _____ No _____

Education - Years Completed
(Check One)

_____ 8 years or less
_____ 9 years to 11 years
_____ high school graduate
_____ more than high school

Circle one correct answer.

1. Storing food and food containers off the floor in the store room

   a. is not necessary if the aisles are kept clean.
   b. must be at least 4 feet high.
   *c. is important in removing hiding places for cockroaches and mice.
   d. makes it easier for an employee to pick up a can.

2. The best way to thaw potentially hazardous foods is in

   *a. a refrigerator.
   b. a covered pan at room temperature.
   c. hot water.
   d. a closed warm oven to keep dust off.

3. The purpose of refrigeration is to

   a. kill germs.
   *b. slow bacteria growth and food spoilage.
   c. make meat more tasty.
   d. dry meat.

4. An overcrowded refrigerator

   *a. prevents cold air circulation.
   b. causes meat to become moldy.
   c. can be corrected by using more containers.
   d. prevents warm air from settling in the bottom of the refrigerator.

5. A good way to tell if a refrigerator is cold enough is to
   a. place your hand inside and feel the shelves for coldness.
   *b. have a thermometer in the refrigerator and check frequently.
   c. have your supervisor check it.
   d. keep the door closed and open only when necessary.

6. Which is not a potentially hazardous food.
   a. cream-filled pastry.
   *b. chocolate cake.
   c. ham salad.
   d. chicken.

7. Before placing hot food in a refrigerator, it should be
   a. cooled in front of a fan.
   b. pre-cooled in the kitchen to prevent spoilage and souring.
   *c. transferred to shallow pans to speed cooling.
   d. cooled slowly at room temperature.

8. Paper and plastic serving items are discarded after use because
   a. most employees do not know how to wash them.
   b. a special sink is needed to wash them properly.
   c. they are expensive.
   *d. they cannot be washed in a manner capable of killing germs.

9. When reheating leftovers or cooked food, it should be
   *a. quickly heated to 140°F. or above.
   b. heated slowly.
   c. put in a large pot and heated in a steam table.
   d. served lukewarm so no one will get burned.

10. A cafeteria is permitted to display and sell hot food if the temperature of the food is
   a. at room temperature but served quickly.
   *b. 140°F. or above.
   c. between 90°F. and 110°F.
   d. kept above 212°F.

11. A food poisoning happens because
   a. food was prepared far in advance of serving.
   b. of carelessness by a food handler
   c. of improper refrigeration.
   *d. all of the above.

12. A safe method of telling when meat has been cooked to a safe temperature is by
    a. covering it with aluminum foil.
    *b. using meat thermometer.
    c. cutting the meat open to see.
    d. smelling.

13. Recontamination of food
    a. can be prevented by wiping the work surface with a damp cloth.
    b. never happens.
    c. is unlikely to happen with flies in the kitchen.
    *d. can be prevented by separating the preparation of cooked and raw foods.

14. Food serving equipment which has cracks, pits and deep cuts should be
    *a. discarded because they are difficult to clean.
    b. used only for cooking leftovers.
    c. used only for storing soup.
    d. kept for use only when banquets are prepared.

15. Foods
    a. can only be contaminated by the cooks.
    b. can only be contaminated during preparation for cooking.
    *c. may be contaminated before reaching the food establishment.
    d. are only contaminated after reaching the kitchen.

16. When soups and gravies are cooked, they should be stirred frequently
    a. to keep the food from boiling over.
    *b. to obtain an even temperature throughout.
    c. to keep the spoon handle out of the food.
    d. to keep bacteria from accumulating on the bottom of the container.

17. Germs that we blow into the air when sneezing
    a. will do no harm.
    *b. will contaminate any food or utensil nearby.
    c. indicate a serious illness.
    d. will die immediately.

18. To reduce the chance of spreading germs, you should
    a. scratch your nose very carefully.
    *b. wash hands after using the toilet.
    c. smoke only long cigarettes while preparing food.
    d. handle food only when your supervisor says so.

19. If you have a sore, infected cut or boil on your hand
    a. wash it regularly with cold running water while preparing food.
    *b. see your supervisor before preparing or handling food.
    c. be careful while preparing and serving food.
    d. leave the cut exposed so it will heal faster.

20. Hair nets and caps should be worn
    a. in the way they are most attractive.
    b. because health authorities say so.
    *c. to prevent hair from falling in to food.
    d. all of the above.

21. A dish that looks and feels clean
    a. is free from all germs.
    *b. can have disease producing germs on them.
    c. is the result of using a dish towel.
    d. can be done only in an expensive dishwashing machine.

22. When there is no hot water at a temperature of 170°F., you should
    a. leave dishes in the water an extra 10 minutes.
    *b. use a chemical sanitizer such as chlorine bleach.
    c. double the amount of detergent or soap.
    d. be more careful when washing.

23. It is recommended that dishes and pots and pans be air dried to
    a. give the dishwasher more time to keep the area clean.
    b. save money on laundering towels.
    c. give detergent a chance to kill harmful bacteria.
    *d. help prevent germs from being spread from a towel to clean dishes.

24. A detergent or soap is used with hot water to
    a. sanitize eating utensils.
    *b. remove the soil from eating utensils.
    c. keep the dishwashers hands soft.
    d. make lots of suds.

25. The first step in properly washing dishes by hand or machine is to
    a. sanitize them first.
    b. wash silverware and glasses.
    c. stack the dishes.
    *d. scrape the dishes to remove large food particles.

APPENDIX D

MULTIPLE-CHOICE

Test B

QUESTIONS

NAME _____
AGE _____
Present Position_____
Years of Experience in food Service _____
Previous Food Handlers Training -- Yes _____ No_____

Education - Years Completed
(Check One)
_____ 8 or less
_____ 9-11 years
_____ High school graduate
_____ More than high school

Circle one correct answer:

1. Food and food containers are stored off the floor to
   *a. permit easy sweeping and cleaning.
   b. provide hiding places for insects and mice.
   c. prevent water lines from leaking.
   d. all of the above.

2. To quickly and safely thaw meat, one should
   a. place the meat in a pan of water.
   b. set it in the open air.
   *c. cook from frozen.
   d. cook something else as no method is safe.

3. Refrigeration of foods
   a. kills germs.
   b. prevents milk from souring.
   *c. slows germ growth.
   d. causes germs to multiply faster.

4. Utensils should be cleaned in the following manner.
   a. wash, sanitize, towel dry.
   b. sanitize, wash, rinse, air dry.
   *c. wash, rinse, sanitize, air dry.
   d. causes germs to multiply faster.

5. Pre-cooling of hot food at room temperature
   *a. can allow germs to grow during the cooling process.
   b. prevents food spoilage.
   c. is a good practice.
   d. can make the kitchen smell better.

6. Health authorities require a maximum refrigerator temperature of
   *a. 45°F.
   b. 15°F.
   c. 56°F.
   d. 60°F.

7. A detergent is needed to
   a. sanitize glasses.
   b. keep the water clean.
   *c. remove the food particles from dirty dishes.
   d. to toughen your hands.

8. The wearing of hair nets or caps is important
   a. because customers expect it.
   *b. in preventing hair from falling into food.
   c. because your supervisor says so.
   d. for an attractive appearance.

9. Boils, infected hangnails, and infected cuts may cause a food poisoning because
   a. food workers are more likely to get cut than other people.
   b. pieces of skin may get into the food.
   c. most workers are usually careless.
   *d. germs from these infections can contaminate food.

10. To sanitize eating utensils means
   a. that you have clean eating utensils.
   *b. to kill disease causing germs.
   c. to rinse them in running water.
   d. to use a detergent or soap.

11. An overcrowded refrigerator.
   a. is always dirty.
   *b. will not circulate cold air freely.
   c. will speed up cooling.
   d. usually contains few leftovers.

12. Which is <u>not</u> considered a potentially hazardous food?
   a. hamburger.
   *b. potatoes.
   c. milk.
   d. sausage.

13. The reuse of paper and plastic serving items
    a. is a good sanitary practice.
    b. is the best way to save money.
    *c. is a sure way to spread germs.
    d. requires special dishwashing equipment.

14. Slow reheating of cooked foods
    *a. can allow time for germs to grow.
    b. improves the flavor of the food.
    c. is a good food handling practice.
    d. to 100°F. will kill all disease causing germs.

15. Germs will increase rapidly if held at
    *a. 72°F.
    b. freezing.
    c. 45°F.
    d. 140°F.

16. Hands should be washed thoroughly with soap and hot water and dried on
    a. a side towel.
    *b. a single use paper towel.
    c. a common hand towel reserved for food handlers.
    d. none of the above.

17. Large masses of food are best cooked
    a. to a temperature of 120°F.
    *b. in several small pans to assure an even temperature throughout.
    c. over low heat to improve flavor.
    d. in large pots so it will cook faster.

18. If you need to cough or sneeze while working, you should
    a. turn your head and continue working.
    b. not worry about it because the food will be served soon.
    *c. use a tissue or handkerchief and then wash you hands.
    d. use your apron tail and then wash your hands.

19. Whether a dishwashing machine will properly wash and sanitize utensils depends upon.
    a. the size of the dishes.
    b. who filled the machine last.
    *c. the employee operating the machine.
    d. none of these because the machine is automatic.

20. Food poisoning is likely to result from
    a. prompt refrigeration of food.
    *b. careless food handlers.
    c. preparing food within a few hours of being served.
    d. cooking food at too high a temperature.

21. A meat thermometer is useful
    *a. to tell when meat reaches a safe cooking temperature.
    b. to prevent getting your hand burned in an oven.
    c. but not necessary if you are a good cook.
    d. to check meat for juiciness.

22. To prevent recontamination of cooked foods from raw foods.
    a. make sure the food has cooled before serving.
    b. wipe your hands clean on a side towel and continue working.
    *c. clean and sanitize the work surface after each use.
    d. let another cook cut the meat.

23. A rinse water temperature in the dishwashing machine
    a. is not important if the dishes look and feel clean.
    *b. of at least 170°F. will kill most harmful bacteria.
    c. should not be more than 120°F.
    d. is not important if you are skilled as an operator.

24. Foods
    a. are usually contaminated by a meat cutter.
    b. can only be contaminated from an infected cut.
    *c. may enter the kitchen already contaminated with insecticides and disease causing germs.
    d. are only contaminated during preparation.

25. Cracks, pits, and deep scratches in food serving equipment
    a. are not a safety hazard.
    b. should be cleaned at least once every other day.
    *c. are hazardous because germs hide and multiply in them.
    d. are only a problem because they look bad.

APPENDIX E

FOOD SERVICE WORKER INFORMATION

PRE AND POST-TEST SCORES.

LEGEND FOR APPENDIX E

SUBJECT - Initials of Participant

EDUC - Education Level of Participant

1. 8 years or less
2. 9 to 11 years
3. High School Graduate
4. More than high school

JOB CLASS - Job Title or Present Position

1. Cook
2. Salad & Bakery Worker
3. Kitchen Aid
4. Dishwasher
5. Dining Room Worker

TRNG. - Prior Attendance in Food Hander Training Program

TEST RESULTS FOR PARTICIPANTS USING
MANUAL A, PRE-TEST B, and POST-TEST A

Sub-ject	Educa.	Age	Exper.	Job Class.	Trng.	Pre-* Test	Post-* Test
GE	2	63	10	1	NO	20	23
UD	1	33	6	1	YES	19	22
GI	1	61	11	2	NO	19	25
DB	4	31	0	3	NO	23	25
RA	3	21	3	4	NO	18	24
TM	3	62	10	2	NO	22	25
WM	3	49	19	1	YES	22	24
LK	3	26	0	3	NO	20	24
MD	2	55	15	3	YES	23	25
ME	1	41	7	1	NO	17	23
MB	3	52	7	1	NO	23	23
CW	1	54	14	3	NO	16	21
LJ	3	58	30	3	YES	18	23
WC	3	49	1	3	NO	22	24
EM	1	46	8	1	YES	20	22
SS	3	54	15	2	NO	19	23
JA	2	24	6	4	NO	17	22
MS	4	50	7	1	NO	20	24
LB	22	51	15	5	YES	19	23
KF	3	57	4	4	NO	21	25
FM	3	58	10	2	YES	22	24
TP	2	56	11	2	NO	20	23
VB	3	52	0	1	NO	21	24
LM	2	62	40	2	YES	23	24
FM	3	51	6	1	YES	24	25
MJ	4	22	1	4	NO	24	25
NH	3	45	12	1	NO	21	23
NM	2	46	12	5	NO	17	22
GH	3	52	13	1	YES	21	25
GA	2	53	11	5	NO	17	21
Mean Total	2.8	47.8	10.1	-	+.33	20.27	23.60

* Numbers of correct answers

TEST RESULTS FOR PARTICIPANTS USING
MANUAL B, PRE-TEST A, and POST-TEST B

Subject	Educa.	Age	Exper.	Job Class.	Trng.	Pre-Test	Post-Test
GG	3	53	21	3	YES	20	22
ED	3	51	8	3	NO	18	23
CZ	3	39	7	1	NO	19	21
MA	4	38	2	1	YES	23	23
LL	3	58	7	5	NO	21	23
MC	2	42	7	4	NO	20	22
HB	1	51	0	3	NO	12	15
DB	2	40	8	1	NO	16	23
LC	1	55	3	5	YES	24	22
GD	3	52	8	1	YES	23	25
BZ	3	26	4	4	NO	19	23
GG	2	25	8	4	NO	12	17
ED	2	22	0	4	NO	15	20
JS	3	48	7	3	NO	20	25
KB	1	36	2	5	NO	18	23
NR	4	23	3	2	NO	18	22
DM	3	30	2	3	NO	19	24
JR	3	50	10	2	YES	22	23
EL	3	46	10	2	NO	20	23
ML	3	38	9	2	NO	17	22
MJ	2	22	7	1	YES	21	25
LB	3	46	8	5	NO	16	21
MW	2	41	10	2	NO	15	18
LJ	4	47	5	5	YES	20	24
LC	4	23	4	5	YES	21	25
CA	3	32	10	5	NO	17	22
MW	3	25	7	5	NO	11	16
HA	3	39	4	4	NO	15	19
GC	2	62	3	5	NO	20	23
TR	3	33	5	5	YES	23	25
Mean Total	2.7	39.8	6.3	-	+.40	18.50	21.93
Mean Total for 60 Participants	2.8	43.3	8.2	-	+.37	19.39	22.77